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PROGRESS





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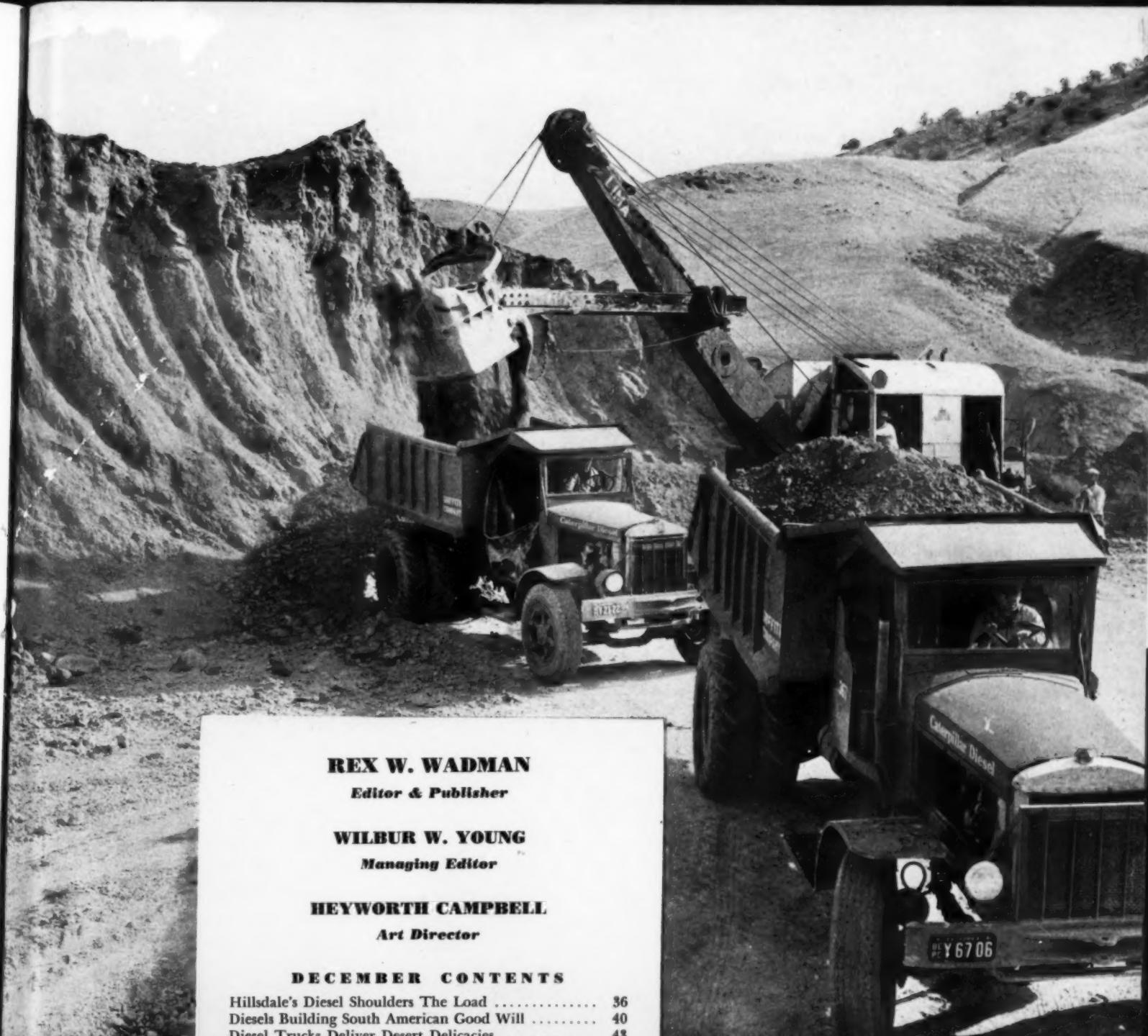
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DIESEL PROGRESS, for December, 1943, Volume IX, Number 12. DIESEL PROGRESS is published monthly by Diesel Engines, Inc., 2 West Forty-fifth St., New York, 19, N. Y. Rex. W. Wadman, President. Acceptance under the Act of June 5, 1943, at East Stroudsburg, Pa., authorized March 27, 1940. Subscription rates: \$5.00 per year, single copy, 50c.



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FRONT COVER ILLUSTRATION: A PC boat powered by twin Cooper-Bessemer Diesels on patrol off the Coast in the Aleutians.

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DIESEL
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By WM. H. GOTTLIEB

WHEN Hillsdale, Michigan, added a 2250-hp. Nordberg Diesel to its existing municipal steam power plant in 1939, it was intended primarily for standby and peak load service. But the vast expansion of war industry forced the engine into base-load operation and Diesel economy and dependability have won an important place in the Hillsdale power picture. The new Diesel has become the most economical power producer in the plant and has made a highly satisfactory record of dependable service.

The last complete year's operating figures show this engine operated 4,875 hours and generated 5,490,000 kw.hrs.; more than 37 per cent of the total production of the plant. The growing importance of the Diesel can be seen in these comparative production figures for the entire life of the Diesel plant:

Year	Diesel kwh.	Steam Plant kwh.	Total kwh.
1939	1,409,000	9,123,000	10,532,000
1940	4,286,000	8,270,900	12,556,900
1941	5,490,000	9,303,000	14,793,000
1942*	4,709,000	8,744,400	13,453,400

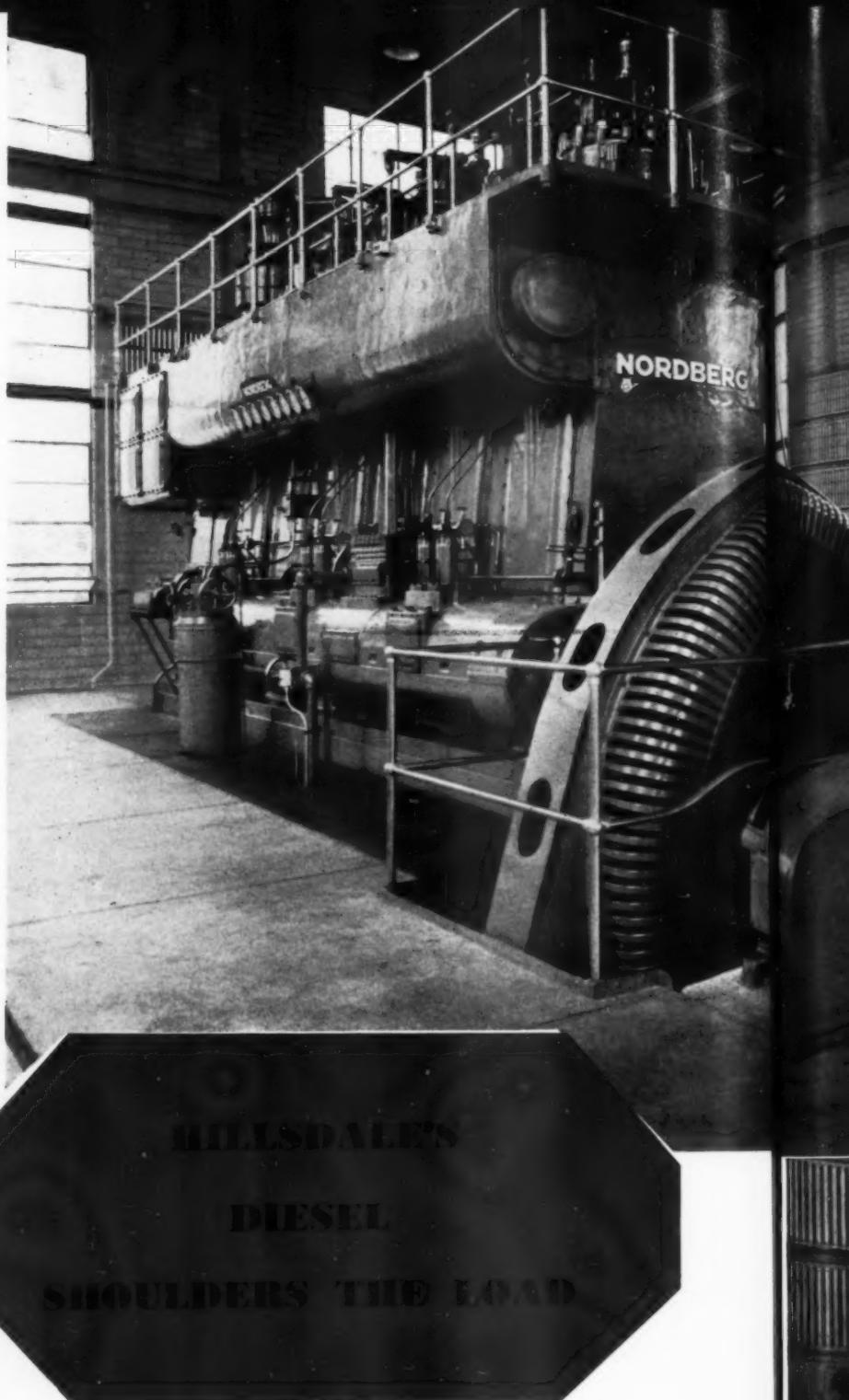
*The figures for 1942 include only the first ten months.

Figures on hours of operation and outage for 1941 show that the Diesel was providing the type of dependable service important in a standby unit but vital in a base-load generating unit that is called on for nearly 5,000 hours of service a year. Here is the statistical evidence:

Operating Year 1941		
Total Hours in generating service	4875:04	55.65%
Total hours of prearranged outage scheduled for inspection and checkup, during which the unit could not have been operated until maintenance work had been completed	360:00	4.11%
Total hours devoted to routine maintenance when unit was not required but could have operated had load conditions required	116:35	1.33%
Total hours of voluntary outage exclusive of that above. This outage included Sundays, holidays, and periods of the day, during which		

load conditions did not demand its operation, but during which time it could have been in service had load demand required its operation 3406:21 38.908% Total hours of forced outage, due to unavoidable failure of mechanical parts or breakdown of auxiliaries. During this period the unit could not have been operated 2:00 .002%

Hillsdale, a city of 6,500 population, has had



long experience in the management of public utilities. Since 1893, its water, light and power requirements have been met by municipal plants, operated under the Board of Public Works. In 1893, a light and power distribution system was installed, and a Corliss engine-driven generator installed to furnish the current. As the years passed, this equipment was augmented by more efficient steam turbines, and finally a steam plant with four Allis-Chalmers turbo generators took over the generating job.

With the further development of the city, it became apparent to the Board of Public Works



in 1937, that additional generating equipment would be necessary to keep pace with the growth of power requirements. After an exhaustive survey, the Board recommended to the City Council the building of a new Diesel plant and the purchase of a Diesel unit for standby and peak load service. With the Hamilton-Weeber Engineering Co. as consulting engineers, the Foulke Construction Co. as building contractors, and under the supervision of H. C. Clark, Superintendent of the Board of Public Works and City Engineer, Hillsdale built a separate Diesel power plant on a site adjoining the steam plant.

The new building is of concrete, steel and brick construction, with a full basement which houses

Left and below: Intake and exhaust sides, respectively, of Hillsdale's 2250 hp., air-injection Nordberg Diesel and 1500 kw. Allis-Chalmers generator.

the auxiliary equipment, a general operating floor for the engine, switchboard, locker room and office, and a first and second gallery for supplies, auxiliary fuel and water tanks and tool cribs. The interior of the building is finished with a two-tone tile, mottled in light green and cream, with cream tile trim. Although the plan called for the installation of but a single Diesel, the building was designed to permit addition of a second unit. Hillsdale engineers anticipated their Diesel success.

Hillsdale's first Diesel is a 6-cylinder, cross-head type, 2-cycle, air-injection Nordberg rated at 2250-hp. at 225 rpm. The engine is directly connected to a 1500 kw., 3-phase, 60-cycle, 2400 volt Allis-Chalmers generator, the excitation of which is supplied by a 25 kw., 1150 rpm. exciter, driven from the generator shaft by means of a texrope drive. The unit has no flywheel, the



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Exterior view of the building erected in 1939 to house the Diesel installed in that year to supplement Hillsdale's existing steam plant.

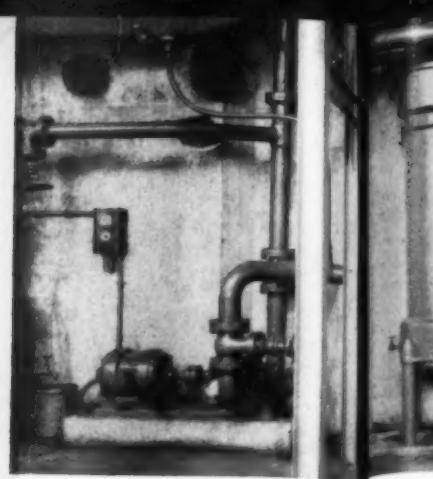
Wr² being incorporated in the generator rotor.

A heavy-duty, air-injection engine was chosen to permit maximum production economy through consumption of a low-cost Michigan fuel. A prime mover which can consume oils that are readily available is truly an asset in these times. Two interconnected steel storage tanks of 100,000 gallons capacity each form the storage space for the fuel supply which can be hauled either by truck or tank car, with suitable unloading facilities for either method. These tanks are equipped with heating coils for use in the winter months, heat being supplied either from the steam plant or by circulating hot water from a heat-recovery system in the Diesel plant. The storage tanks being at a slight elevation above the transfer pump, the fuel flows by gravity to the transfer pump and then is pumped to the day tanks on the gallery, approximately twenty feet above the engine

level. These are cylindrical tanks with cone shaped bottoms and are equipped with automatic float switches which control the starter for the transfer pump, a 1# Blackmer, size 20, gear-type pump, direct-connected to a 1 hp., 3/60/220 type AR Allis-Chalmers motor, operating at 860 rpm. The day tanks as well as the storage tanks are indicated by King telegages.

The fuel oil runs by gravity from the day tanks to the service tank which is of 500 gallon capacity. A Bowser meter is installed in this fuel line for measuring the consumption of fuel oil.

The service tank has two compartments, one of which is supplied with coils if further heating of the heavy fuel oil is desired. The other compartment stores light fuel oil, which is used to shut down and start the engine after periods of outage. The tank is also equipped with a float



Left to right: Allis-Chalmers water and oil strainer; pump, and oil strainer.

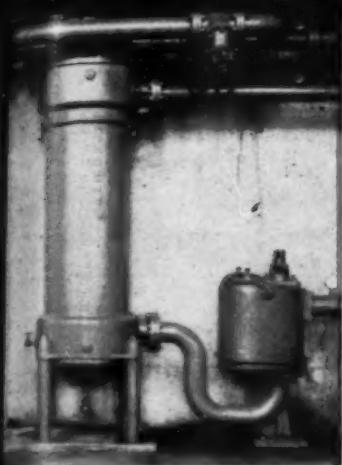
valve to maintain a constant level of oil from the day tanks. A consistent return of 11.6 kw.hrs. per gallon of low cost fuel represents genuine fuel economy for the Hillsdale plant and an air-injection engine.

Engine intake air is supplied through a battery of American Air filters installed in a separate filter house adjacent to the main building. Air enters the filter house through a tall intake stack which tops the building and insures a cleaner air supply. The exhaust muffler, just outside the plant, is equipped with specially constructed heating coils so that waste exhaust heat may be put to useful purpose. A Chicago pump circulates water through the muffler coils and then through coils in the fuel tanks and radiators which heat the power house. This is a closed system and is equipped with expansion tank and relief valves. An Ahlberger-Buffalo steam heating unit was provided for use when the Diesel is not in operation.

A closed dual-circuit system is used for cooling the Diesel. Treated water is circulated through the engine jackets and through a Schutte & Koerting heat exchanger by a 4-in. Allis-Chalmers centrifugal pump rated to deliver 565 gpm. against a 70 ft. head and driven by a 15-hp., 1750 rpm., direct-connected motor. Raw water for the cooling system is taken from wells, supplied from a nearby lake, and put through the heat exchanger and an oil cooler by a second Allis-Chalmers centrifugal pump.

The soft water pump is allowed to operate at full capacity at all times, and the temperature of both soft water and oil is controlled by throttling the raw water circuit. Both water and oil circuits, cylinder heads and heat exchangers are equipped with Motoco Dial type thermometers having a range of 60-200 degrees F.

The Diesel is lubricated with three grades of oil. The crankcase oil is an S.A.E. 30 oil, the compressor oil a compound S.A.E. 30 and the cylinder an S.A.E. 40. The crankcase oil is cir-



Allis-Chalmers pump, and Schutte & Koerting filter and oil strainer.

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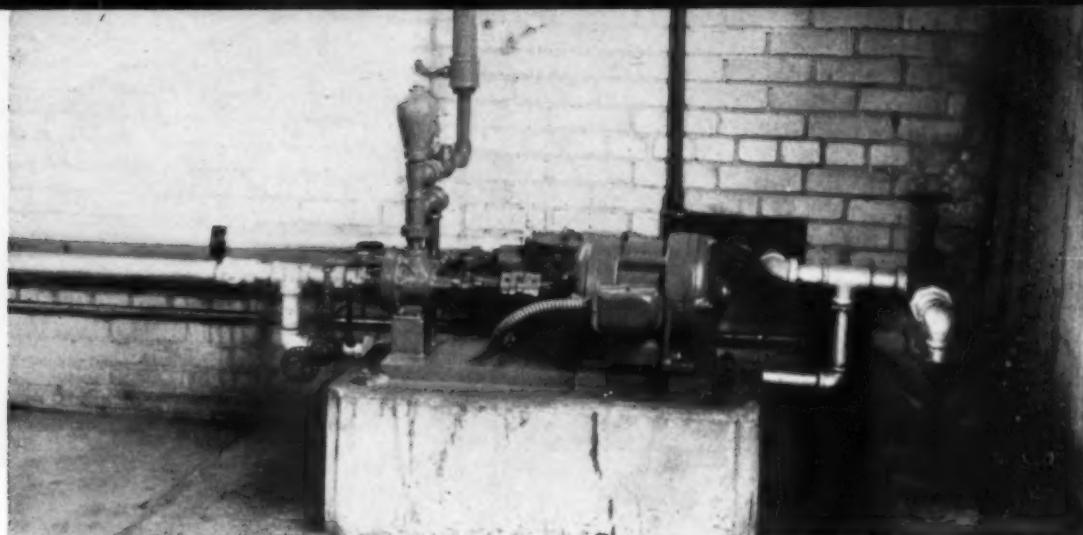
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culated by means of a built-in pump to all bearings and moving parts, and also to the pistons for the purpose of cooling. A Blackmer auxiliary lube pump, driven by a 7½-hp. Allis-Chalmers motor, can serve in emergency and in starting and starting the engine. Lube is cleaned every 30 days in a Youngstown-Miller oil purifier. The compressor and power cylinders are lubricated by Manzel force-feed lubricators.

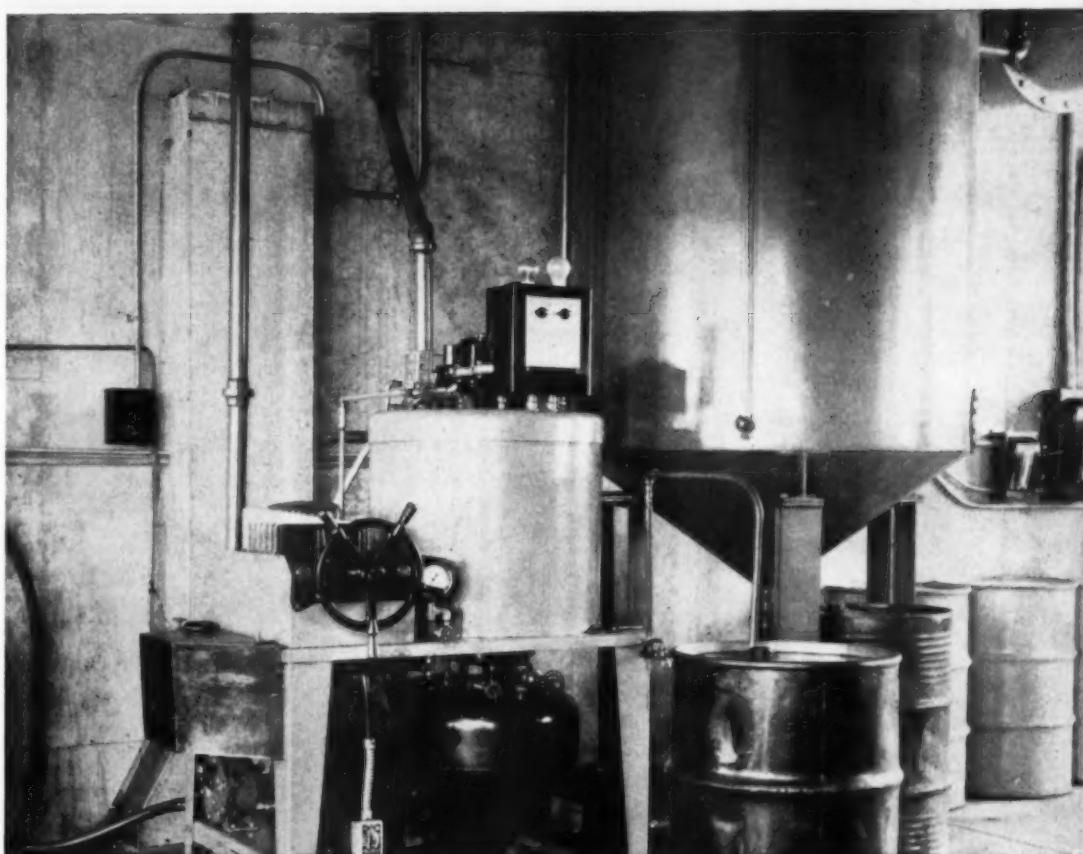
The starting air equipment consists of a Gardner-Denver, 5½"-1½" x 5", two-stage compressor, driven by a 15-hp. Allis-Chalmers motor. This equipment is for auxiliary purpose in pumping up the starting air in two 28" x 120" welded steel tanks designed for 1300# pressure and tested at 1800# hydrostatic pressure. These tanks are protected by suitable safety relief valves. A complete system of alarms and safety devices is installed on the engine.

The electrical control equipment consists of a modern switchboard with an Allis-Chalmers rocking arm type of voltage regulator, and General Electric a.c. Ammeter, a.c. voltmeter, wattmeter, d.c. Ammeter and d.c. voltmeter. It is also equipped with an emergency push button control for tripping the main oil breaker at the steam plant. All control of the distribution system, synchronizing of units and operation of governor controls and speed regulation is done at the main switchboard in the steam plant. The Diesel is equipped with a Woodward governor and can be controlled by means of remote control switches at the main operating board.

Steam and Diesel have made a successful operating team at Hillsdale with the emphasis shifting steadily toward the Diesel plant. With each year the Diesel operating schedule is extended until now the engine is called upon to carry a base load for as much as 18 hours a day. With evidence on the books that running the Diesel means dollar savings, Chief Engineer R. L. Gregory is glad to use this prime mover whenever load conditions make it advisable.

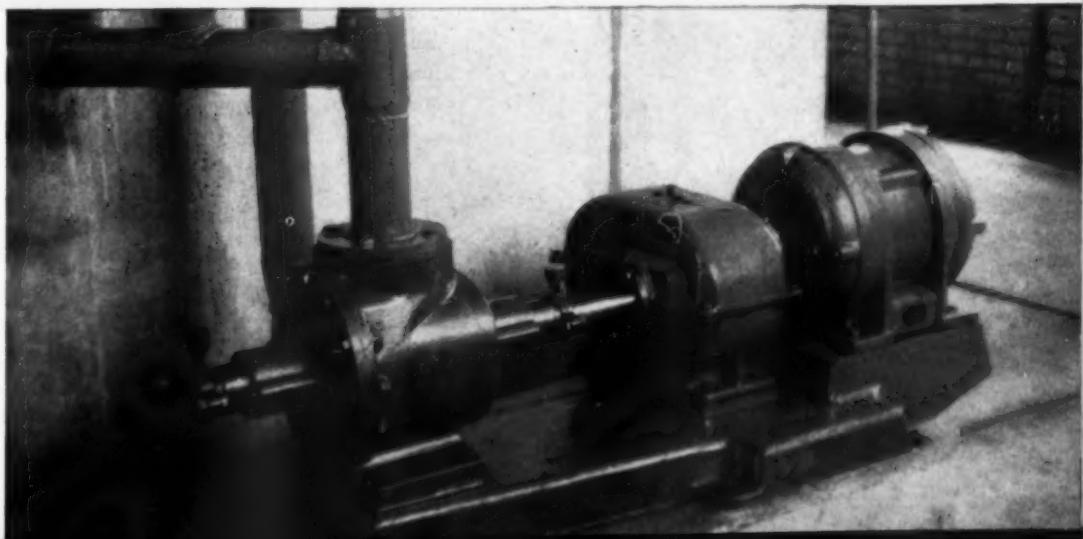


The Blackmer fuel oil transfer pump.

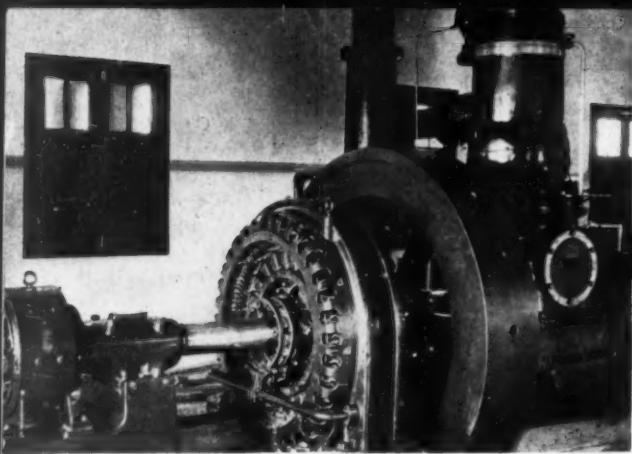


Lube oil is periodically batch cleaned in this Youngstown-Miller purifier.

A Blackmer auxiliary lube pump used in before and after and in emergencies.



DIESELS BUILDING



First of two F-M units installed at Mompos, a single cylinder 75 hp. Diesel.



Typically Spanish power plant building at Mompos, Colombia. The facade conceals elevated water tank and cooling tower.

THE colonial city of Mompos, located on a branch of the Magdalena River about 70 miles from its mouth, with a population of about 14,000—lived on the glory of its past until the advent of the present liberal government, when greater interest was displayed for the education of the masses.

The city of Mompos derives its name from that of an Indian chieftain, which as near as the early Spanish "conquistadores" could translate the Indian pronunciation seemed to be Mom-pox and for many years, during the colonial days, this was the name given to that city. History seems to be rather uncertain as to the date of the founding of the city, but the historians seem to agree that the period dates from 1539 to 1541 in which the founder of the city, Don Alonso de Heredia arrived in that section of the country which establishes the fact that the city of Mompos ranks with those of Santa Marta, Cartagena and Bogota as being the first cities established by the early Spanish nobility in their conquest of the New World.

In the early colonial days the city of Mompos was the seat of the Vice Royal or "Virrey," direct representative of the King for the district, which now comprises the Department of Bolí-

var, Santander and part of Magdalena, and the splendor of those days is reflected in the massive colonial homes with their typically beautiful wrought iron grills of windows and doors with their coats of arms of the Spanish nobility worked into the artistic designs.

With the advent of the liberal government under Dr. Enrique Olaya Herrera, increasing attention has been given to public education and due to the widespread fame of the Colegio de Pinillos and probably to the fact that Mompos was one of the few cities left in Colombia with the colonial traditions, the National Government has selected this city as a University City and are now building a normal school whose cost is estimated to be \$450,000.00. With the advent of this new school and the nationalization of the Colegio de Pinillos combined with two very important parochial schools, Mompos again becomes a very important city in the future life of the Republic and in view of this and of the Government's large building program in Mompos, it was deemed necessary to supplant the obsolete steam plant power which had been in operation since 1916.

Mompos at this time was making plans to commemorate the 4th Century of its foundation

and the National Government agreed to donate to the city a sum of money for this purpose with provision that this money would be employed in the building of a modern light plant with capacity sufficient to take care of the future needs of the new normal school and the nationalized Colegio de Pinillos.

Fairbanks-Morse & Co.'s representatives entered into the spirit of the historical tradition in the commemoration of the 4th century and designed and constructed a power plant building to conform with the predominating colonial architecture of the city using the feudal tower at the right to enclose the water tank and cooling water tower for the circulating water of the engine and ice plant installed in the building.

The plant was put into operation about a year ago and due to the very low fuel costs using the locally produced bunker oil it was possible to lower the existing rates to such an extent that the load for private lighting increased considerably beyond their expectations. Fortunately the building was designed and the trench piping arranged for the installation of a second unit of 150 hp. so that this new unit may be added without any major alterations to the existing layout.

Although the installation is only about a year old, for the past six months the unit has been working on a twenty-four hour daily schedule and up to the present writing has not called for any repair parts.

Since the original date of this article, the second unit consisting of a 150 hp. Fairbanks-Morse Diesel has been installed and at the present time indications are that before another two years are up a 3rd unit will have to be installed.

This is particularly interesting from the fact that the first unit, a 75 hp. engine took the place of an obsolete steam plant with a maximum peak load of less than 20 kw. that had been in service for 25 years and it was thought that the proposed 75 hp.—46 kw. set was entirely too large. However, due to the economical operation of the F-M unit using the Tropical Oil Co.'s fuel oil at \$0.04½ per gal. the city was able to greatly reduce the rates with a very considerable increase in the private demand for current.

DING SOUTH AMERICAN GOOD WILL

By DWIGHT ROBISON

Puerto Colombia, Atlantico

THIS town, as a marine port, is relatively new. The original port for this territory up to about 1898 was Salgar where the vessels anchored out in the roadstead, protected by a spit of land. The freight and passengers were carried ashore by lighters and passed through the old colonial customs house located on the hill above the village of Salgar. Due to the silting of this port by the immense quantities of sand carried down by the Magdalena River, the continuous grounding of both the vessels of then moderate draft and of the lighters, made this port unsuitable and steps were taken in the early 1900's to change the port to the fishing village of Puerto Colombia where a short wooden pier was built for vessels with a maximum draft of 14 ft. The narrow gauge railroad was extended along the coast and was embraced into the new Barranquilla Railway & Pier Co. for the servicing of the new port.

In the early 1900's the industrial importance of Colombia demanded greater freight handling facilities and the wooden pier was extended further out to accommodate vessels of greater draft but it was soon seen that the wooden pier, at the best was only a make-shift so that by 1912 a steel and concrete pier was being carried out, bent by bent, supplanting the old wooden structure until it reached a length competing with the long piers of the world or to an overall length of just a few feet under one mile.

After the first world war Puerto Colombia had a period of great activity with very short lapses of temporary lulls until about 1938 when the long dreamed of and long agitated "Bocas de Ceniza" project was an accomplished fact. During this period of activity and specially during the period from 1924 to 1929 the accumulation of freight, due to the lack of both port facilities and to the single track narrow gauge road, was so great that every available foot of space both on the pier and shore was piled high with freight of every description.

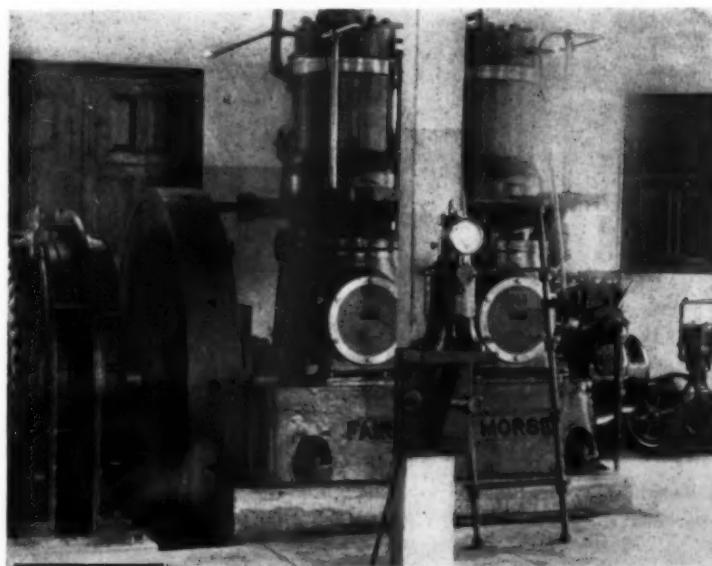
Later the subsidence of traffic to the now obsolete port the town of Puerto Colombia seemed doomed to a natural death but fortunately during the year 1932 the residents of Barranquilla

began to realize the importance of Puerto Colombia as a sea-side resort and with the event of the highway between that city and Barranquilla finished about that time, a few hundred beach homes were built on the beaches adjacent to the town which has given the place a new lease on life.

The history of the electric light plant of Puerto Colombia seems to follow the pattern of that of many other towns and cities of this section of the country in that the first plant, installed in about 1916, was a small steam plant at a time when the only local fuel was an abundance of wood. At that time labor was cheap and the forest was relatively close so that a steam plant even with the immensely inefficient non condensing steam engine made for fairly cheap power but as the cost of labor increased and the length of haul of the fuel became greater a new source of power was necessary and in 1930 a Deutz 110 hp. unit was installed. The

Deutz engine was one of those built before the "Ersatz" and Hitler came into vogue and though poorly adapted due to the electrical characteristics and poorly serviced by the agents, this gave rather intermittent service up to October 1939 when the Fairbanks-Morse 150 hp. Diesel was put into service.

Following a general practice the new power plant building was built with the provision of space for an additional unit and hopes are entertained by the municipality that with the ever increasing load due to the continued building program of beach houses that shortly there will be both the need of additional generating equipment and funds available for the purchase of same. In this, as in many other F-M installations the ability of burning low priced fuel oil combined with the sturdy trouble free feature of the F-M engine has made it possible to establish rates within the reach of all classes of the population.



F-M 2-cylinder Diesel and 97 kw. generator at Puerto Colombia. Note air starting equipment, right, and injector test stand, center.



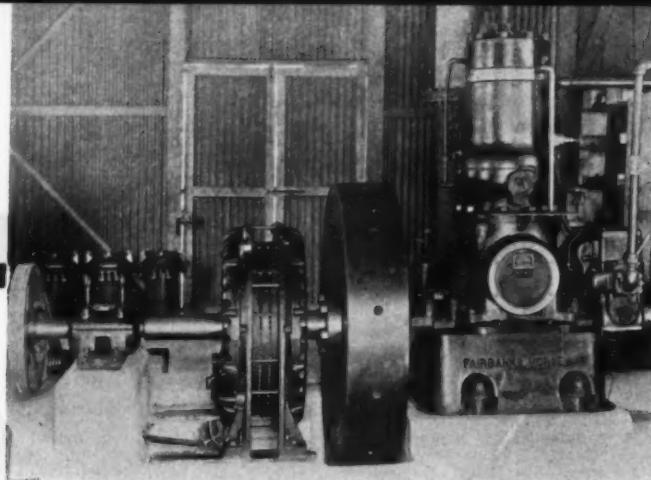
The Puerto Colombia, Atlantico power plant building.

**DIESELS BUILDING
SOUTH AMERICAN
GOOD WILL**

Continued

**SABANALARGA,
ATLANTICO**

Above: The single cylinder F-M Diesel and 36 kw. alternator installed at Sabanalarga in 1937. Right: High tension lines from plant to city.



THIS is another of the coastal cities of Colombia whose electric light plant history follows the pattern of those of Puerto Colombia, Baranoa, Galapa and Mompos and in which the steam plant was installed about the year 1916, followed by years of continued difficulties in maintaining service due to the ever increasing cost of fuel and eventually solved in a haphazard manner by the installation of internal combustion engine generating sets whose physical and electrical characteristics were such that the life of the plant was short and the service during the period very unsatisfactory.

In Sabanalarga, following the period of steam plant operation, a relatively high speed German Diesel engine direct connected to a 3-wire, 220 volt direct current generator was installed. The engine was of the intermittent service type, poorly serviced by the manufacturers agent and only a few months after its installation operational difficulties were encountered, these difficulties increased as the natural wear of the engine became apparent. While the engine difficulties were grave enough the electrical characteristics were probably worse when you consider the distribution of 220 volt over an area of 5 square miles and even with No. 00 conductors on the main leads the voltage drop at the extremities was often as much as 60%. After the failure of the first internal combustion plant a Fairbanks-Morse single cylinder, 60 hp. Diesel generating set was installed about 5 years

ago with its 36 kw. generator taking the place of the 20 kw. unit in the former plant. This unit on an operating schedule of 12 hours daily established a perfect record for the 5 years of its operation and by establishing the faith of the public in a continuous and uninterrupted service was able to build the load from less than 15 kw. at the inauguration of the new plant up to a peak of 39 kw. which this unit was carrying during the 3 hours every night and with a waiting list of more than 15 kw. for private lighting which could not be filled for lack of generating capacity.

The second Fairbanks-Morse unit was put into service in the latter part of last year and consists of a 2-cylinder 120 hp. engine direct connected to a 76 kw. generator which has a present peak load of 60 kw. and it is anticipated that as soon as the supply of house wiring materials gets back to normal, there will be more than enough additional load to take up the entire generating capacity of the second unit and steps will have to be taken either to arrange for the synchronization of the two units or the load be split during the peak period.

One of the features of interest on this Sabanalarga job was that the first unit was housed in a corrugated iron shed with barely enough room to take care of only the one unit and no attempt was made or money spent to make false facade to hide the ugliness of the building.

At the time that this unit was being purchased the Municipality and Department were only able to raise a specified amount of money which was to be augmented by an equal sum to be furnished by the National Government. The total amount was barely enough to purchase the engine and allow for enough to revamp and extend slightly the old direct current distribution system with a slight balance for the shed type building. Considerable agitation was encountered in the Municipal Council against the proposal of putting the money into equipment and leaving nothing for a building that would not be a disgrace to the city and after a great deal of discussion the matter was put up to the Governor of the Department who decided on the basis that if they purchased good equipment for heavy duty continuous service they would be able to make the money required for a decent building out of earnings and that if they put the money into the building they would have neither service nor even the benefit of the building.

That this decision was sound has been proven by the fact that now after a little over 5 years of service the Municipality has been able to raise funds on the basis of its uninterrupted lighting schedule to purchase a second unit of double the capacity of the first unit, build a plant building in keeping with the aspirations of the city council and extend the distribution system over the entire urban area.

DIESELS DELIVER DESERT DELICACIES

By JIM MEDFORD



Eastbound desert transport train of Diamond T, Cummins Diesel engined tractors and Fruehauf trailers.

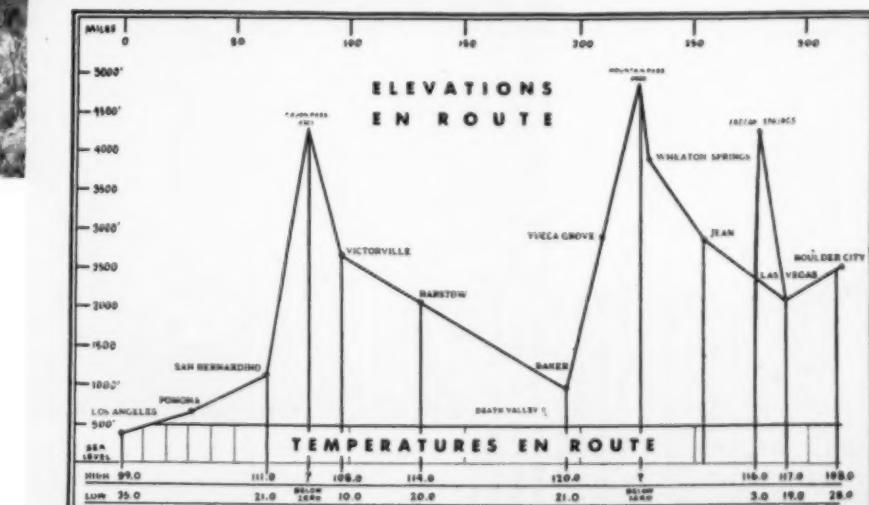
g purchased were only money which sum to be spent. The to purchase revamp and ent distribution or the shed on was en- cial against into equip- building that and after a was put up by who de- nased good bus service y required s and that building they the benefit

BILL, it was here in 1850 the emigrants turned off into Death Valley and perished of starvation." It was Tim Harvey talking to his assistant as the giant Diesel tractor and its semi-trailer rolled through the gap of the 4,250-foot summit of Cajon Pass.

They were herding the lead unit of six transports on the perishables run, Los Angeles, California, to Las Vegas and Boulder City, Nevada. This 314 miles is through the most contrasty country served by motor transport — orange groves, zero mountain summits and 120-130 degree desert floors.

Those pioneers Tim was talking about would have welcomed these trucks and if their "shades" were armed with half a million red or brown ration stamps and \$20,000 they could make a bid for the life-giving commodity loaded in Tim's truck—BUTTER.

Engined by Cummins Diesels, these Diamond-T six-wheel tractors with their Fruehauf dual-axle



semis specially built for Nevada Consolidated Fast Freight operated 2,127 scheduled round trips over this route in 1942. That's 1,336,000 miles carrying 83,486,840 pounds of foodstuffs and other perishables in and out of the desert where life at its best is a compromise. The writer knows, he spent a year there all at one time, and liked it, too. On the westbound it's essential metals and war plant materials raw from the desert mines and chemical plants. The operating cost for engine fuel is 8 cents

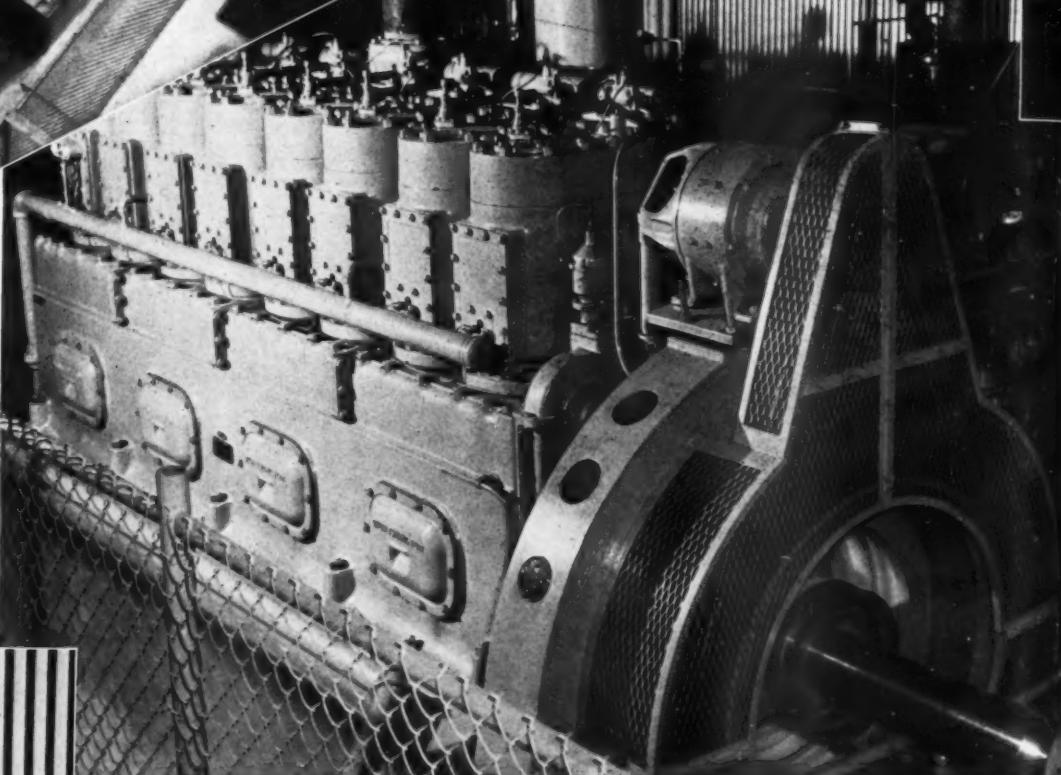
per gallon including 3 cents state tax using 110 gallons of oil per round trip per unit. Lube oil is changed every two round trips or at approximately 1,260 miles using Macmillan Ringfree SAE 30 with Cograph (graphite base) additive. Operating with Cummins Diesels on the head end since 1937, Willard E. Mullikan, the Line's "GM" says: "As far as I am concerned these are swell automotive Diesels." Sounds as though he means it because they're delivering miles for the low cost of 1.33 cents.

AN EMERGENCY GAS ENGINE INSTALLATION

By JIM MEDFORD

Above: Bird's eye view of the two Worthington, 300 hp. gas engines and GE generators in the Douglas Aircraft plant. Note Air Maze oil bath air cleaners and Maxim exhaust silencers, upper background.

Right: Close-up of one of the Worthington gas engines. Note Pickering governor and generator shaft extension to pump drives. Below: The two Worthington, 2-stage compressors and air receivers.

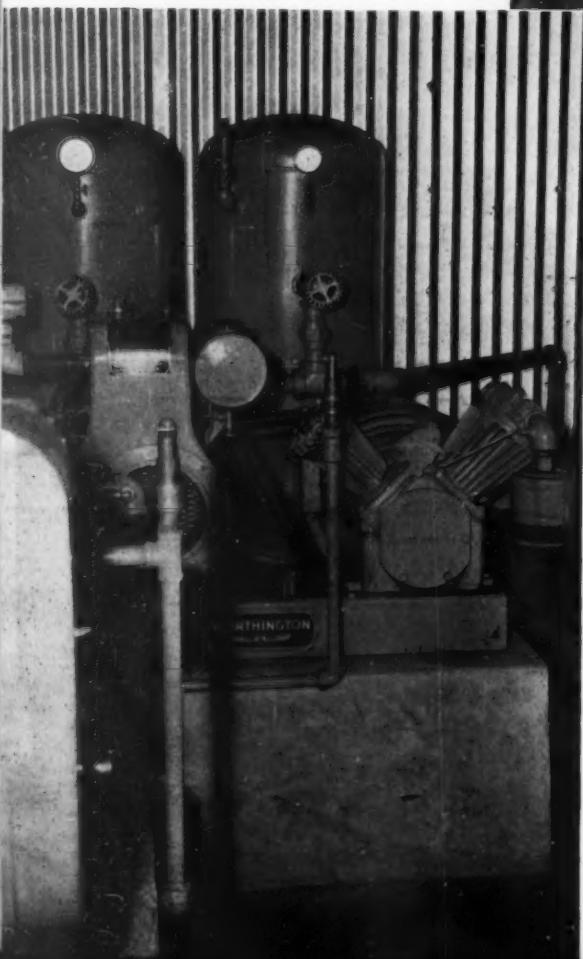


In what yesterday was open range of an early California Spanish Rancho, as if by magic, today there sprawls a modern gray structure that is a small world in itself. It is the Long Beach, California plant of the Douglas Aircraft Company. Square miles of floor space within its air-conditioned interior are occupied with giant machines and assembly lines that require more men and women to operate than are found in many a city's entire population.

Engaged in the production of essential materials and dependent on outside power sources, it was necessary that provision be made for un-

interrupted service in the event of the disruption of the usual source of energy.

Through the collaboration of H. P. "Phil" Henderson, sales engineer for the Worthington Pump and Machinery Corporation, and Loys Griswold, commercial engineer of the General Electric Co., an automatically-controlled pair of gas engine compressor-generator units were installed. These engines are eight-cylinder Worthingtons, angle type, four cycle, single acting, 11½" bore, 12" stroke, rated 300 hp. each at 350 rpm. Each unit is fitted with an emergency a.c. generator which also acts as a flywheel.





Vault of 1500 kw General Electric switchboard and distribution panel.

These combined flywheels and generators form an efficient unit that is also compact.

The generators are 2400 volt, $52\frac{1}{2}$ cycle, 250 kw., 200 kw. at 80 per cent power factor. The fields are energized by 125 volt, 1750 rpm., $7\frac{1}{2}$ kw. excitors V-belt driven and mounted on top of generator frame forming a close-knit arrangement where floor space is at a premium.

Raw water from regular plant supply is used in engine circulating water systems as make-up only. The closed type cooling system consists of two Worthington evaporative coolers installed on the roof, one for each unit. Circulation is maintained by individual pumps belt-driven from their respective engines. Pumps are of 120 gpm. capacity and provide jacket water at temperature of 160-140 degrees with 68 degrees wet bulb. The evaporative cooling fans are motor driven from emergency light circuit providing continuous operation regardless of which power source is supplying energy. The thermostatic control is automatic.

Engine starting is with air at 250 pounds pressure from two storage tanks, 20" by 60". Supplying this air are two-stage, $4\frac{1}{2}$ " and $2\frac{1}{2}$ " by $2\frac{3}{4}$ " compressors driven by manually controlled gasoline engines.

Constant speed Pickering governors maintain engine speed holding it to within 4 or 5 per cent which is sufficiently close for compressor work. Fuel consumption is 10,000 Btu. per bhp. hr. Engines are quickly changeable from natural gas to butane mixture. As an additional

emergency provision butane tanks are installed and switching of fuel source is done through a three-way valve.

The compressor cooling system is distinct and separate from engine system. It is equipped with its own evaporative cooler, blower, and 60 gpm. circulating pump cooling from 96 to 80 degrees on basis of 68 degrees wet bulb thermometer. Both engine and compressor jacket water is circulated by centrifugal pumps driven through multiple V-belts from sheaves on the main engine shaft.

Supplementing the engine driven compressors, are two horizontal duplex, two-step compressors -23 " by 14"-direct connected to synchronous electric motors energized by the regular outside power service. These motors are 300 hp. at 231 rpm., 2300 volt, three phase, 50 cycle, with 10 kw. motor-generator excitors. Their delivery is equal to the capacity of the auxiliary engine-driven units, 1532 cubic feet per min. of free air compressed to 110 lb. gauge. Compressed air is stored in receivers similar to those already mentioned. Evaporative cooling is also a feature and circulation is by monobloc type motor-driven pump. The multiple-step unloading is governor controlled.

Under normal conditions the engines are on compressor service and the exciter field circuit is held open so there is no voltage on either exciter or alternator. At this time there is no additional load on engine other than the rotation of generator, now simply a flywheel, and the exciter. One or both of these engine-driven

units is on the line and running at all times. Thus, in the event of power failure, at least one unit is connected to its automatic feeder panel. However if both are running, the preferred one is connected through an automatic contact actuated by an under-voltage relay that operates after $1\frac{1}{2}$ seconds delay to avoid operating on power surge or temporary line fluctuations.

When the machines take up their electrical load the compressor cylinders are automatically unloaded. This is accomplished by means of a solenoid valve in the exciter circuit. This valve becomes energized when the generator field builds up. When energized, this solenoid valve passes air from the main receiver to the unloading system on the compressor cylinders, opening all suction valves to the atmosphere, completely unloading the compressor end of unit.

All controls are centered in multiple deadfront General Electric main switchboard. This switchboard includes two generator panels, one for each machine, and two feeder circuit panels. The generator sections have overload relays, ammeters, volt meters, and magnetic contactors. In addition there are direct-acting generator regulators of the latest type. One feeder section is automatic, the other manually operated.

When normal power returns after a failure, the transfer back to normal operation is done at the main normal supply circuit breaker by operating a control switch which picks up under-voltage relay and removes excitation from exciters. This done, it remains only for attendant to close the main circuit breaker and the plant is back on its line supply again with all set for the next emergency. Once the load is removed from the generators, the machines take up their duty as of previous to the interruption, that of normal engine-driven air compressors.

In addition to the Worthington gas engine angle compressor-generator units and their General Electric alternators, other interesting items of equipment include: evaporative coolers, lube oil cooler, air compressors by Worthington; motors by General Electric; governors by Pickering; lube oil filter by Cuno; lube oil pressure control by American Taglebue; lube oil pressure alarm by Ashcroft; multi-B-drive V-belts by Worthington-Goodrich; intercooler safety valves by Lonergan; water valves by Crane; intake air cleaned by Air Maze oil bath filters; exhaust silencers by Maxim; Titan shutdown valves with Square D switches. Lube oil is 30 SAE by General Petroleum.

CATS UNDER THE MIDNIGHT SUN



THE cat "swings" blast the 40-below grey void as they thunder up to the railhead at Peace River to take over from the Alberta Northern the contents of gondola and box car out of Edmonton, Alberta, 550 miles "up south" via Athabasca Landing.

From the Peace to the new oil fields at Fort Norman, bellowing cats roar through the thousand miles of scrub growth via Fort Providence and on into the wild lands north to Norman Wells, 150 miles short of the Arctic Circle. To the Arctic Sea, the MacKenzie country extends "down north" from Great Slave Lake. This silent and trackless area really begins in the scrub on the banks of the Peace.

Through the rough growth and over a varied terrain the sleds creak along behind the roaring Diesels; steel runners protest to the intense friction. Bunting poles take up the slack between units with a protesting and groaning as the swing crashes through the swamp pitch holes. Their banging in their saddles clatter a crude cadence. The swing pushes ever north, doing ten knots if you're nautical. Steep banks menace, but a couple of bull hitches around a tree hole with a heavy cable carried for that purpose eases the train down the slope. In

places, the train is cut and the cat doubles the hump. At night, weird shadows come and go ahead through the dancing headlight's glow.

Northern transportation is the toughest proposition on earth. Up to fifteen years ago this long mush was made at the end of a sled's gee pole with the plane beginning to take over for those that had the dinero. But for heavy hauling of tonnage it called for something more—the Diesel track tractor.

Although for a long time, more than thirty years to the writer's knowledge, men have known of the oil north of Great Slave, it was the demand for fuel at the Southeastern Alaska air bases that brought the dollars from Uncle Sam's pockets to pay for a second tote road into Canada's great Northwest and MacKenzie Territories and the Yukon, and the Canol Project but 450 miles almost due east of Whitehorse, Yukon Territory, on the recently completed Alaska Highway.

Seventy-degree weather greets the swing as they get under way during the short days when the sun dogs chase their parent close to the horizon. It's a gaunt land. Sleighs thirty feet long and half as wide, with a Diesel cat ahead and a

Or

Oil Is Where You Find It

By JIM MEDFORD

crummy tied on behind, head out over the hastily built trail surveyed by airplanes and dozed out by cats. Supplies had to go in during the freeze, the road would go through the next spring. So, they slushed the muskegs and built up the lake and river ice to four feet, the minimum thickness that would hold the swing, by plastering on snow and water by dozer and tanker.

Four to six units to the swing, the cats roared in, their crews as colorful as the country or their job. It was like pioneer railroading and they rode the bucking sleds with their twenty tons like shacks on brownies before they put the air on the pig ahead. Sleeping and eating as they could in the crummy with no eight hour

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Left and above: Caterpillar Diesel tractors haul 65-ton barges and their tugs on the 16-mile portage from Fitzgerald, Alberta, to Fort Smith, N.W.T. enroute to Norman Wells.



Here they roll through deep mud bound for the Slave River, thence to Norman Wells in the MacKenzie basin.



Caterpillar Diesel tractors building road in tough terrain up in N.W.T. to blaze the way to Norman Wells for equipment trains.



Water and mud, ice and frozen muskeg are all the same to Diesel tractor and Le Tourneau carryall scraper. This is a U.S. Army Signal Corps photo.

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law to cramp their style, the swings blasted on toward Fort Providence, the only break in the thousand miles, the halfway mark. Then on again into the Arctic and Norman Wells.

But before the swings can do a year 'round job, it was necessary to build a proper road that would give a rubber tire reasonable decency and respect due so rare and valuable a part of industry. It's a herculean task to roadway this back-of-beyond wilderness. Building roads in impossible places has become a habit with our Corps of Engineers and the civilian contractors that go along for something more than the ride.

And what a ride. If you've never seen a Cater-

pillar Diesel tractor with a trailbuilder or dozer up forward push off into the wilderness north through a stand of timber so close it slows down a bull moose answering a mating call, you've missed something. The skookum guy at the head of the expedition hands the skinner of the lead cat a map and a compass and they're off. Some sections they're lucky enough to find tree blazes to follow, put there by the transit men after the aerial survey.

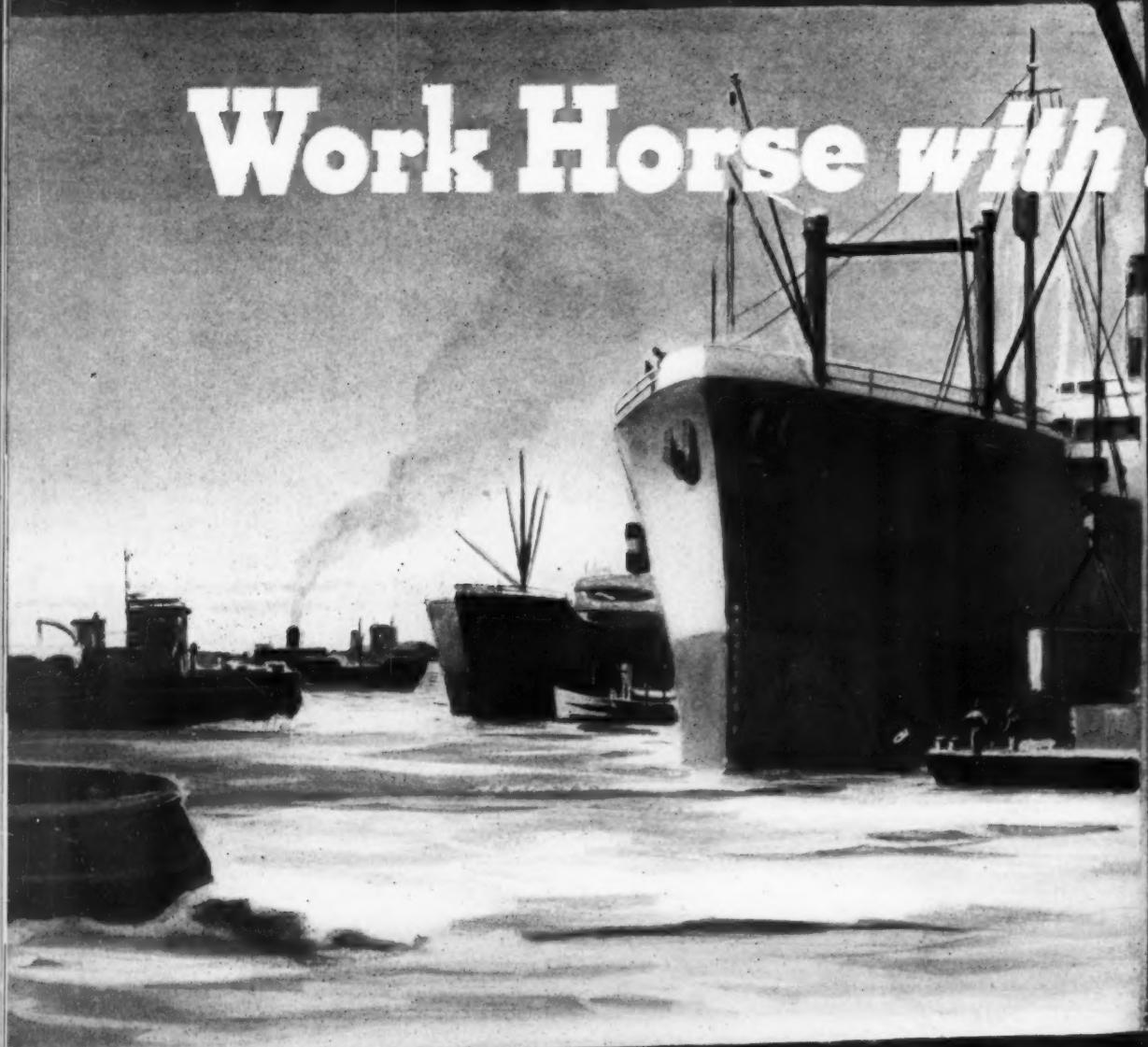
From the railway they lay their own tracks and crossing the open, the lead cat pushes its dozer against a tree, or two or three trees, and because the frozen ground does not encourage the putting forth of tap roots, the growth is crashed for a center line. Behind comes a pair of cats

swamping out to full width of the clearing. To the rear of these roll two pairs of cats cleaning up, filling depressions and generally rough grading the hasty construction. Final grading is done with more cats and earth carriers assisted by trucks and other road making equipment.

Then, behind roll the pieces of water transportation for lake and river—barges, tugboats, ferries—on specially built low-bed trailers. Then follow the pipe and supplies—an endless stream of modern industry's tools.

That it is a job is evidenced by the sign stuck on the employment shack at headquarters: "This is no picnic. If you can't take it, don't apply."

Work Horse with a gentle

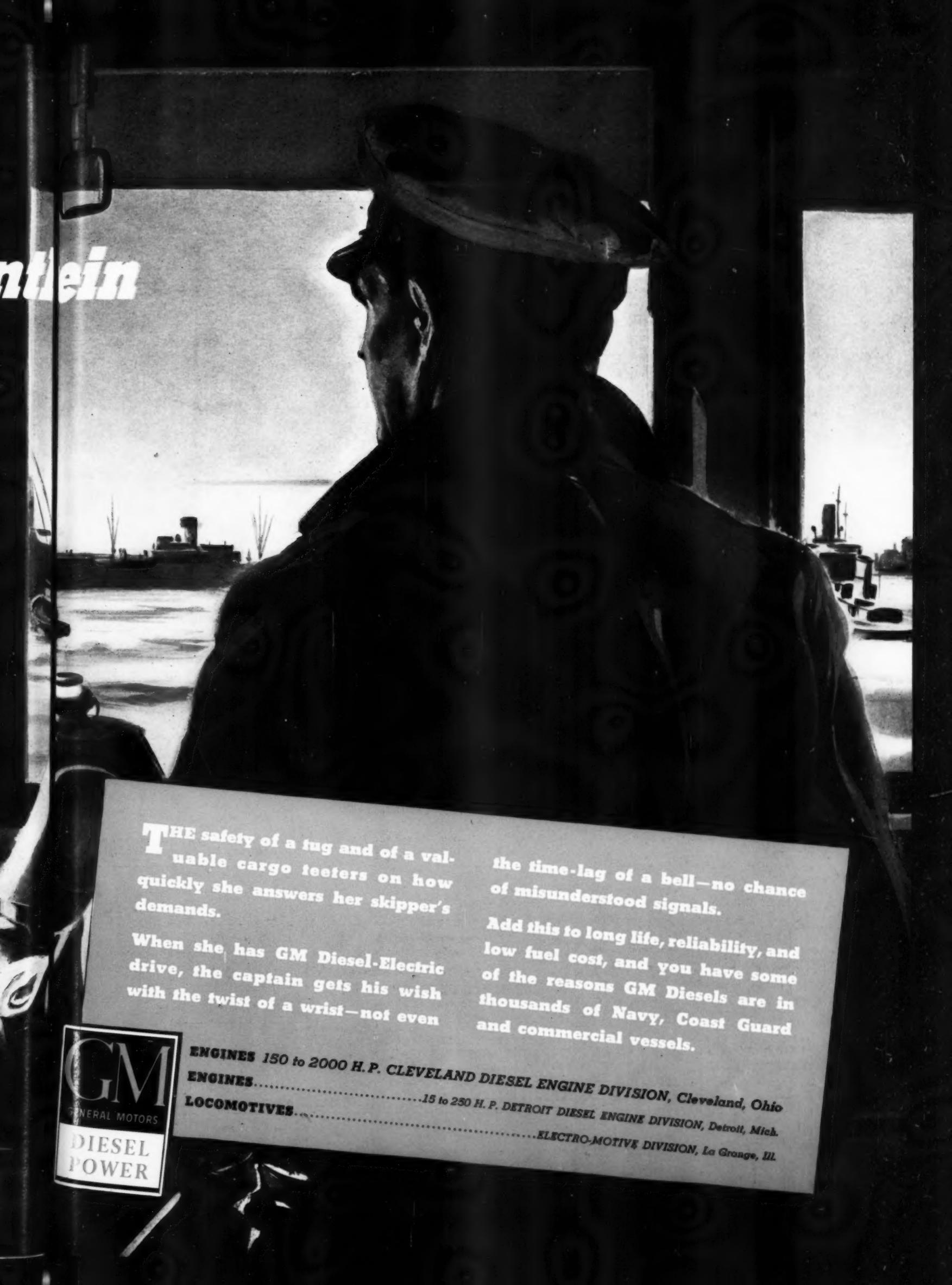


Back the Attack
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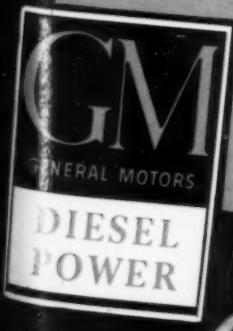
THE safety of a tug and of a valuable cargo teeters on how quickly she answers her skipper's demands.

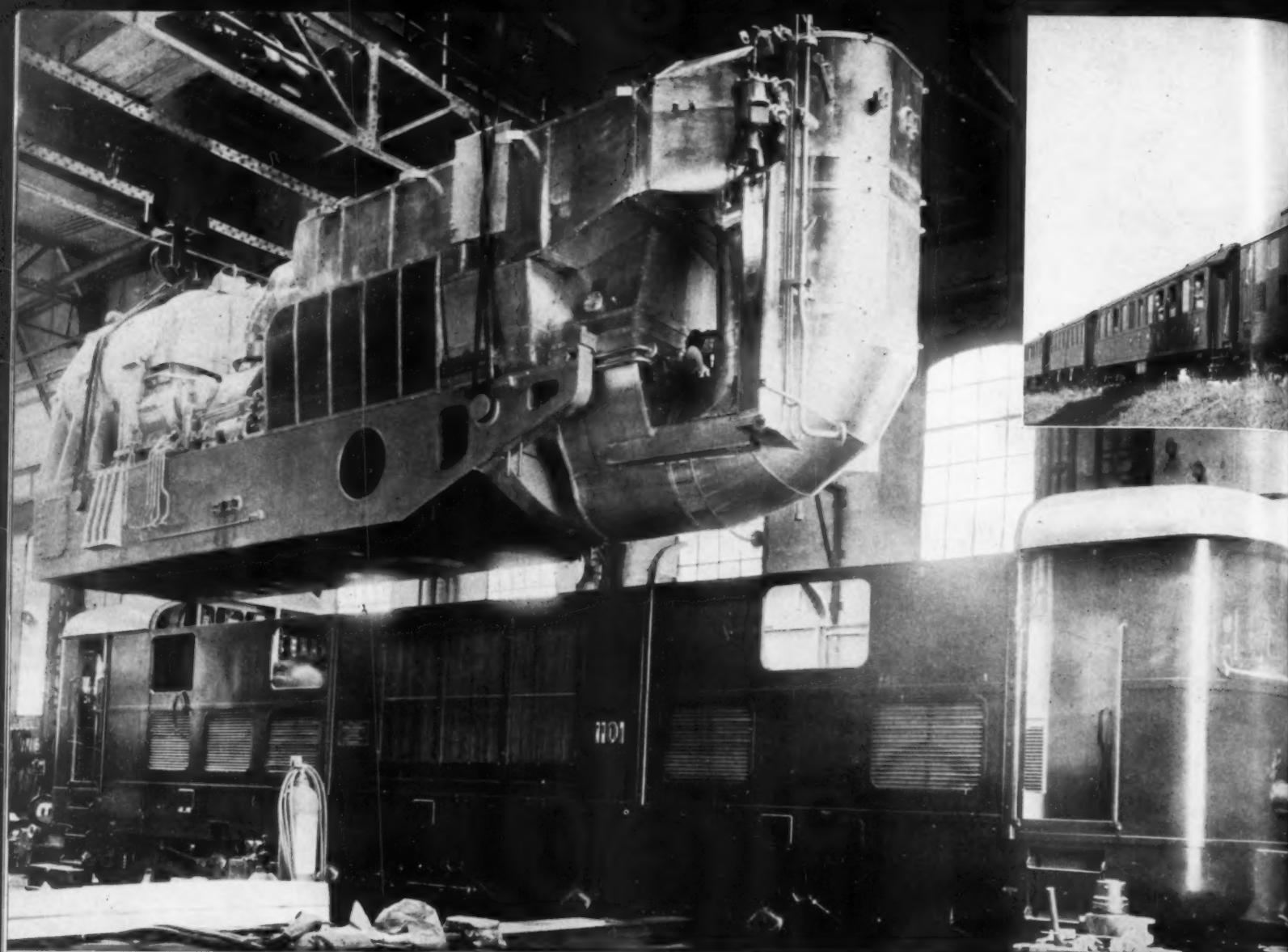
When she has GM Diesel-Electric drive, the captain gets his wish with the twist of a wrist—not even

the time-lag of a bell—no chance of misunderstood signals.

Add this to long life, reliability, and low fuel cost, and you have some of the reasons GM Diesels are in thousands of Navy, Coast Guard and commercial vessels.

ENGINES 150 to 2000 H.P. CLEVELAND DIESEL ENGINE DIVISION, Cleveland, Ohio
ENGINES..... 15 to 250 H.P. DETROIT DIESEL ENGINE DIVISION, Detroit, Mich.
LOCOMOTIVES..... ELECTRO-MOTIVE DIVISION, La Grange, Ill.





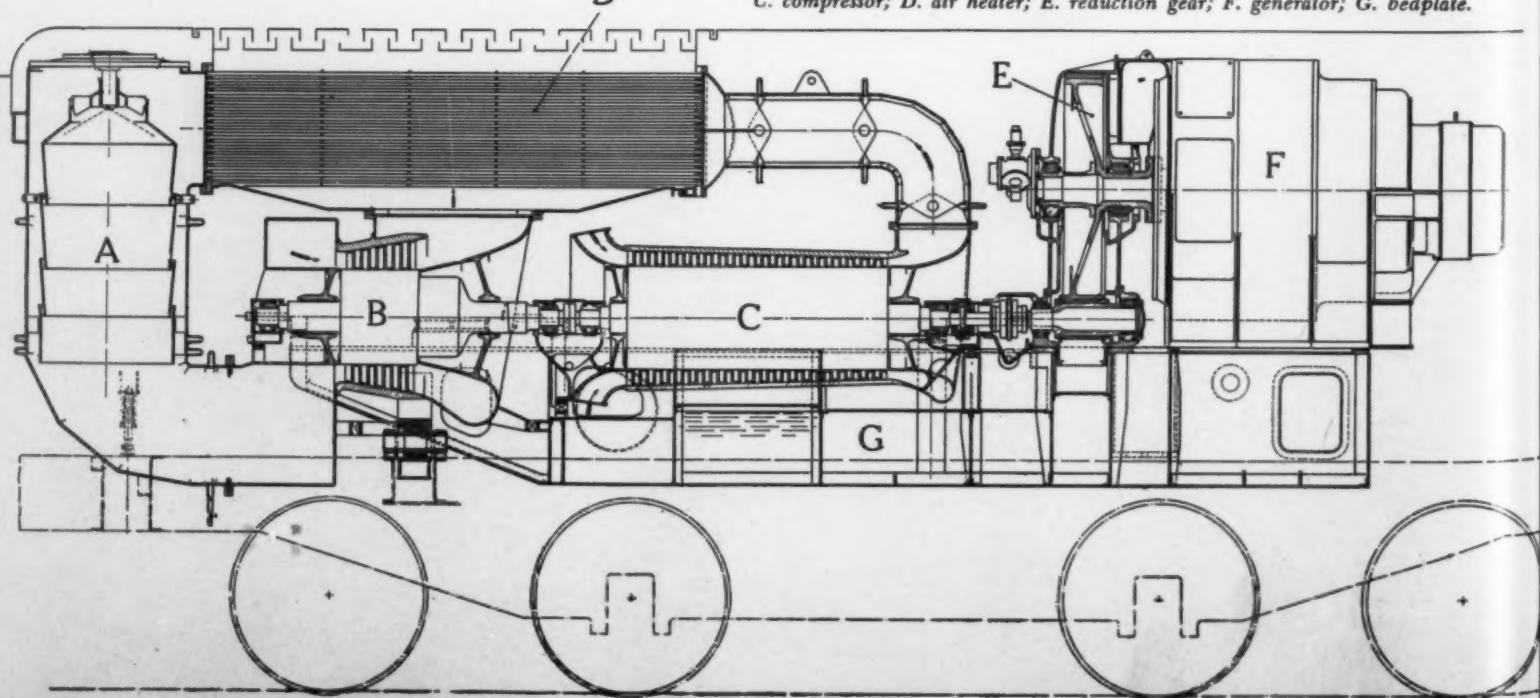
The complete gas-turbines and generator are assembled on a common sub-base and lowered as a unit onto the locomotive chassis.

THE GAS TURBINE

A Practical Application

By WILBUR W. YOUNG

Section through the power unit. A. combustion chamber; B. gas-turbine; C. compressor; D. air heater; E. reduction gear; F. generator; G. bedplate.



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The Swiss Federal Railway train which is powered with a Brown-Boveri gas-turbine locomotive.

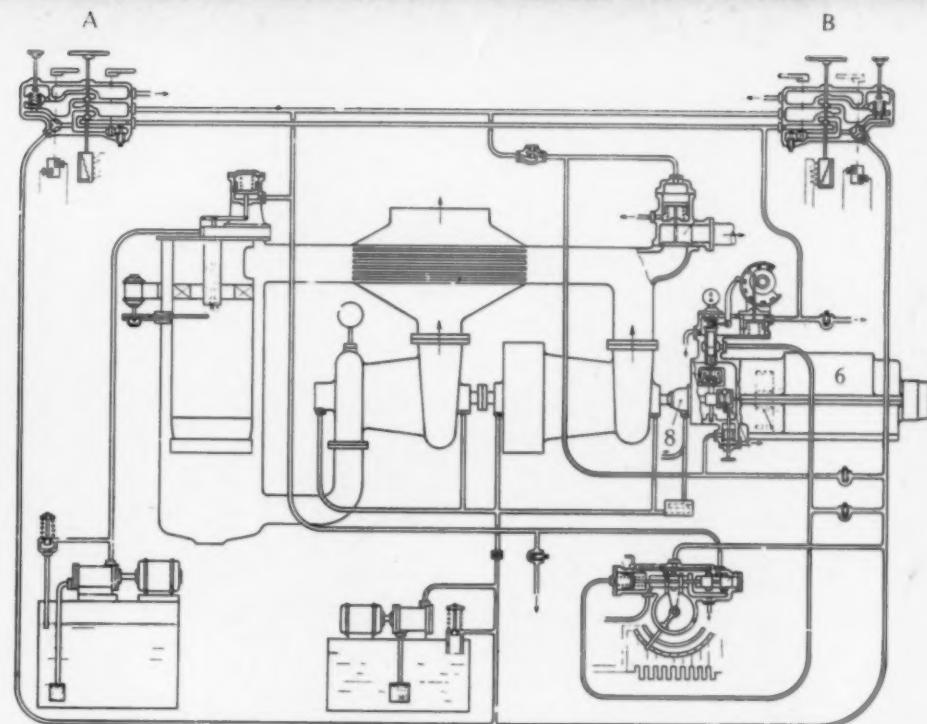


Engineer's station in the locomotive cab.

All illustrations courtesy
Paul R. Sidler, Brown-Boveri

In the August issue of DIESEL PROGRESS the simple working principles of the Gas-Turbine were outlined and although much of its development and uses in this country are veiled in wartime secrecy we were permitted to mention the names of four well known concerns and tacitly hint at a fifth now building these machines in the United States. That, our first article on Gas-Turbines pointed to the twenty-seven known American, and two outstanding foreign installations.

Come peace, it is fairly certain many important developments in American Gas-Turbine design and application may be revealed. Meantime, although this machine is being hailed in the



Schematic arrangement of the gas-turbine generator unit and controls. A-B are the engineer's controls.

public prints as the first really new kind of power plant in half a century it will bear watching.

Details of the Swiss Gas-Turbine locomotive, built by Brown-Boveri, are here made available to our readers through the courtesy of its American representative Paul R. Sidler. This locomotive outwardly looks like its European prototypes, being characterized by a pair of extending buffers and link and hook couplers. The running gear consists of two center axles which are rigid in the frame and two 4-wheel swivel trucks. For operation in the Swiss mountains, individual rail plows are of course provided.

Two of the four traction motors are geared to the two rigid axles and the other two are geared to each of the inside truck axles. A control cab is provided at each end of the locomotive.

The view of the Gas-Turbine generator unit being lowered into the chassis shows that the unit occupies the entire midships section of the locomotive also that it is essentially a compact, self-contained unit. The operation of the prime mover was detailed in our first article but it is interesting to note that the unit is started by motoring the main generator until the compressor attains speed sufficient to supply air at pressure and volume required for turbine operation.

Now here is a peculiar characteristic of more

than passing significance. Although this locomotive is designated as a 2200 hp. unit, it actually develops this output at the generator when the outside air is -4°F. Here is the picture:

Outside Temperature	H.P. of Gas-Turbine	Generator Output—H.P.
-4° F.	3600	2200
+32° F.	2850	2100
+68° F.	2200	2000
+100° F.	1700	1500

This is the reverse of what we expect in steam and even Diesel locomotive performance and its implications are left to those more versed in such behaviors.

The only protective device required is an automatic control which prevents overheating of the fire box due to insufficient cooling air or excess fuel. Electrical loading is automatically controlled in the same manner as is common in Diesel locomotives.

We are told that this Brown-Boveri locomotive has given good account of itself and we may possibly conclude that it will prove to be the forerunner of a new breed in railway motive power. The Gas-Turbine, however, in its present form, is limited to the upper power brackets, say 2000 hp. and up, and still relies upon its lower first cost and simpler construction to offset its lower efficiency which is now about half that of the Diesel. More on this phase of the Gas-Turbine will appear in an early issue of DIESEL PROGRESS.



Four Murphy Diesels, Konomoc Pumping Station, New London, Conn. Note Burgess exhaust snubbers.



EFFICIENT

DIESEL

PUMPING

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By WILL H. FULLERTON

THE recently completed pumping station for the City of New London, Connecticut, is located at Konomoc Lake, on the New London-Hartford Turnpike, some six miles west of the city line. Konomoc Lake is an irregular-shaped pond of clear water, with sand and gravel bottom and shores, with water shed carefully protected from pollution, and with pine tree plantings surrounding it. At the nearest point to the highway, a substantial gatehouse has been built, housing two 24 in. C.I. suction lines, leading under the highway, across to the pump station. From the pumping station, there are two 24 in. C.I. discharge lines up to three reinforced "pre-form" concrete standpipes, each 90 ft. outside diameter and 35 ft. high, with domed tops, and each containing 1½ million gallons when full. Each main discharge line from the pumping station branches into three 12 in. feeders, one to each tank, entering at the center, and extending up 12 ft. This provides a constant head on the

pumps up to that level. Both suction and discharge mains are ample in size, with very little friction loss.

Half way up the hill, each discharge line is properly valved, and feeds the new city supply, through 24 in. lines connecting to the present gravity system from the Lake, and at this junction, water for the city can be taken by the previous system, or under the new pressure, which is now sufficient to service all parts of the city.

It was decided to make this pumping station outstanding in high economy, and for that reason Diesel engines were selected, direct-connected to high-grade centrifugal pumps, especially designed for the operating conditions. The resulting combined efficiency of engines and pumps is over 75%, pumps being 85%, engines 90%.

The engines are Murphy Diesels, each having cylinders $5\frac{3}{4} \times 6\frac{1}{2}$, with a maximum governed speed of 1200 rpm., and 85 bhp. continuous rating, thus giving a fuel oil consumption of about .4 of a pound per brake horse power hour, from half-load to full load. A 5000 gallon storage tank is buried outside, feeding fuel oil to a supply system, with return line for the surplus. The engines are equipped with fuel and lube oil filters, and governed by a hydraulic Servo-type governor, with automatic safety controls, to meet any possible emergency. The jackets, water-cooled exhaust mufflers, and oil coolers, are served by heat exchangers which take their supply from the discharge main and return it to the suction main, the water first passing through the exhaust manifolds, and thus maintaining highest safe temperatures for the cylinders.

The units are started by storage batteries, in which the voltage is maintained by automatic charging, and because of the pump characteristics, the units are started instantly without clutch detaching, or any trouble whatsoever. A centrifugal pump requires very little power input in starting, and not until discharge speed is reached, somewhat different from reciprocating units.

Exhaust from each engine passes through large snubbers to separate exhaust lines, extending through the rear wall into a dry-well with free vent to the top of the building. Expansion strains and movement is thereby avoided. Two of the engines drive generators through double V-belts, and have voltage regulators to compensate for changes in operating speeds, because one of the advantages of such pumping units is

that rotation can be changed to suit variations in suction and discharge heads, as conditions require. Each foundation is en bloc, separate from the building, and resting on hardpan.

The Morris centrifugal pumps have 10 in. suction and 8 in. discharge nozzles, with check valves and gate valves on both sides, to permit isolation of any unit and also to prevent any possible back leakage from the tanks to the Lake. Ordinarily the lake level is sufficiently high to always keep the pumps primed, ready for operation, but there is another higher level supply which can be used in case of very low water in Lake Konomoc, after which the pumps lift the water from the latter.

Runners of these pumps were carefully selected to suit operating conditions, with the peak of the efficiency curve from 1600 to 2800 gpm. and speeds of 1130 to 1200 rpm., so that they always operate at their best loads, and therefore require minimum power input.

Ordinarily one or two units will be sufficient to maintain necessary levels in the standpipes, but in case of emergency a third unit can be cut in, leaving one unit in reserve. While the plant will be available for pumping twenty-four hours a day, it is expected that the ample standpipe capacity will avoid night operation, except in case of excessive demand from any cause.

Preliminary tests indicate a cost of less than one-half cent for fuel oil per thousand gallons, lifted 120 ft., and a remarkably low lube oil consumption, due to the complete system incorporated in the design, together with the very careful filtration which is used. This is the first high-grade water works installation of its kind along the Atlantic Coast, and it is expected to show excellent efficiency, due to superior equipment, and no gears.

The engines were supplied by Murphy Diesel Company, and incorporate their well-known injector design, where the complete assembly can be removed intact, for examination, cleaning, or repairs. The pumps were built by Morris Machine Works, and are their standard heavy-duty, double-suction, bronze-fitted, design.

Generators and switch panel were furnished by General Electric Company, exhaust snubbers by Burgess, and heat exchangers by Sims. The pumping equipment was installed by Starkweather Engineering Company, as subcontractors to N. Benvenuti & Sons, New London, who had the entire contract, which was under the direction of Mr. Kenneth H. Holmes.

View of the four Murphy Diesels and Morris, 1750 gpm. pumps. Note Sims heat exchangers.

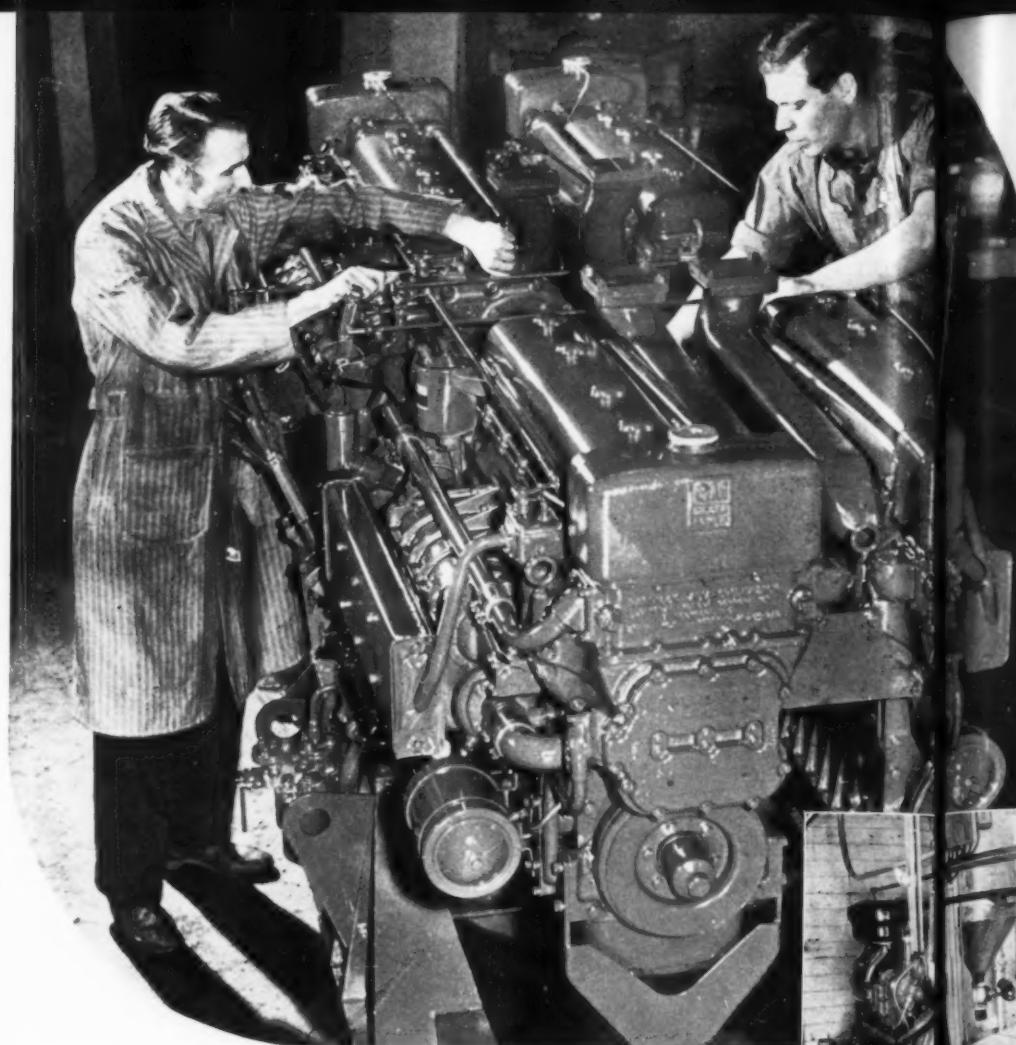
MULTIPLE marine engine installation in the Diesel-propelled work boats of America was just beginning to gain wide acceptance when America became involved in World War II. This engineering technique, like many another, went to war. How it has been advanced and developed in a field of effort far from that of its peacetime origin cannot be told in detail until after hostilities cease. Much, however, has occurred which is an open book; and the practice is so sound, worthwhile and useful and with a future assured in the post-war world that it warrants study and attention now.

In considering the engineering practice of multiple-engine installation the first point to be considered is why several small powerplants should be called upon to do work which could easily be accomplished by one large engine.

There has long existed, and there is long likely to exist, certain important gaps in the power-plant needs of work boats which are not covered by any corresponding Diesel application elsewhere in industry. The answer for this is not difficult to find. In over-all figures the demands engineering-wise of the work boats, particularly those of the fishing fleets, have always been comparatively small. Therefore it has not been economically practical either for the engineer to design nor the manufacturer to tool to this important but still specialized market. In general, boats requiring 200 to 500 h.p. do not find available any engine built in mass production for other industrial applications. Until the advent of the still little understood principle of multiple-engine installation, work boats requiring this range of propulsion power were denied the use and efficiency of modern high speed Diesel engines. Denied also was the savings in engine bulk and weight with a consequent loss of cargo space.

But multiple-engine marine installation might not have materialized had this been all there was to the problem posed by fighting boats. If it had been, the solution would have been in the installation of two separate engines driving separate propellers. But these boats imposed other demands. They required a single large propeller in line with the keel, for few fish boats have found the twin-screw installation successful because the propellers foul nets and trawl lines.

In approaching this highly specialized problem, it was seen that an important lesson had already been learned in the engineering construction of many big ocean liners, where turbines were made to transmit their combined power through gearing to a single shaft.



Above: The "Quad," multiple Diesel Marine drive recently developed by General Motors. Right: Two, 6-cylinder Gray Marine Diesels installed in tandem on the "Vagabond."



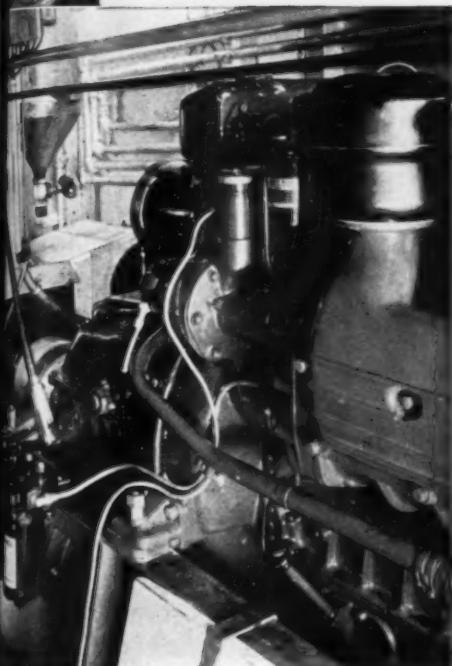
Above: The trawler "Vagabond" repowered with two Gray Marine Diesels, each with a 2:1 reduction gear and a final 2:1 single gear. Below: "Chignik 4," a cannery tender powered by two GM Diesels equipped for marine propulsion by Gray Marine Motor Co.



MULTIPLE DIESEL MARINE DRIVE

By

FRANCIS WALTON



requires laying up the boat for a considerable period. Repair parts are also high-priced by comparison. Operators know that loss of even a few days' time can sometimes mean the price of the engine.

When a multiple-engine installation is used the boat can still be operated if one engine requires repairs. The boat can come home under its own power without a tow. And finally small engines are comparatively so inexpensive that the operator can often afford to have one on hand as a spare.

The history of multiple-engine marine installa-

tion has shown instances where such advantages as these have been reported: 25% less cost; 57% less weight; 20% more speed; 50% more power; 60% more cruising range.

The history of multiple-engine marine engine installation, which has produced these records, is a comparatively short but impressive one.

Pioneering in the commercial fishing field along this unique engineering line was done in 1939 by the United Welding Company of Boston, in the well-known installation on the *Vagabond*, an 86 ft. trawler, in which there were installed two standard 165 h.p. Gray Marine Diesels. (This is the 71-series, two-cycle Diesel engine built by General Motors and equipped for marine propulsion by the Gray Marine Motor Company.) Driving through a Farrel-Birmingham gear the new high-speed engines replaced an older engine. In this case two reduction geared engines developing a total of 330 h.p. and weighing 12,000 lbs., including the gear replaced a direct drive 180 h.p. engine weighing 28,000 lbs. Each engine in this installation was connected through flexible couplings. The *Vagabond* has now had four years of successful operation. The repowered *Vagabond* was fully described in DIESEL PROGRESS for February 1940.

Based on its experience with the *Vagabond*, the United Welding Company in 1941 similarly powered a larger boat built by the Lemos Yard at Riverside, R. I., for the Atlantic Navigation Company. This was the *Caritas*, a 103-foot beam trawler, powered with three of the 6-cylinder Gray Marine Diesels driving to a single propeller through a special Twin Disc gear. The engineering work was done by the United Welding Company in cooperation with the Gray Marine Motor Company and William H. Hand, Jr., the designer of the vessel. This craft was immediately taken over by the U. S. Navy.

Other manufacturers were working meanwhile in the same direction. Three years ago there was an ingenious installation of two Cummins Diesels on the West Coast, driving to a single shaft with vee belts, and there was the widely-publicized installation of two Gray Marine gasoline engines driving through vee-belt arrangement to a single large propeller in a 56-foot cannery tug owned by the Chignik Packing Company.

In still another field, West Coast timber operators have successfully used two engines geared together on drag lines and other applications.

Until recently multiple-engine installation has been thought of primarily as the hooking together of but two engines. The advances made over this original arrangement to meet special needs of war were for a considerable time kept secret. Finally the United States Navy permitted announcement of a new technique of engine combination by which horsepower delivery to a single propeller shaft is increased four-fold with important savings in weight and space.

The new power plant, in production for nearly a year and being widely used in various landing barges of the United States Navy, is known as the Quad.

The Quad consists of four standard six-cylinder General Motors Diesel engines geared to a common propeller shaft in such a manner that the assembly occupies relatively little space, permitting greater capacity for troops, tanks, vehicles or other cargo. The basic engines are identical with many thousands of the same model furnished for the smaller landing boats of the Navy and Army, and widely used in tanks, tractors, trucks and stationary and portable power installations.

Cruising range is increased by the flexibility of the engine arrangement coupled with the use of controllable pitch propellers.

Much of the space economy in the Quad results from the basic design which permits placing blower, starting motor, generator and other accessories on either side of the engine and rotation of the crankshaft in either direction. By placing accessories on the "out" sides, the engines in each pair in the Quad can be located exceptionally close to each other. These design features permit mounting the two pairs of engines in the base in such a way that all four engines are attached to a gear located centrally; thus the power is geared to the propeller shaft beneath the center of the entire assembly. Controls are located at one side of the centralized gear box.

The story of this simple yet unique installation and all that it means in the field of marine propulsion tomorrow would not be complete without reference to the use of a controllable pitch propeller such as the one developed for marine applications by General Motors. Using such a propeller, boats running at low speed, such as in trolling operations, can run on half the normal engine output with an attendant large saving in fuel.



Officer Personnel in staff of Inspector of Machinery at Fairbanks-Morse, Beloit: (front, left to right) Ensign B. B. Boulis, Lieut. R. E. Wright, Lieut. R. A. Martens, Commander J. M. Hicks, Lieut. R. S. Norris, Lieut. R. C. Kravik, Ensign J. B. Albright; (rear, left to right) Ensign J. H. Fox, Ensign R. O. Pintner, Ensign A. G. Dill, Ensign T. M. Alexander, Ensign J. E. Peters, Lieut. E. J. McCleary, Jr.



By DWIGHT ROBISON

THERE is no such thing as perfection in manufacturing. A modern blueprint accepts the fact that there will be slight deviations from any arbitrary figure of dimension. This is called tolerance, and the amount of permissible plus or minus for any part will vary according to its size and intended use. The blueprint of the six-inch shaft may demand a measurement between 5.9995 and 6.0005 inches. Within these limits, the shaft will have been found to function perfectly at its intended occupation. Devices for measuring can easily record accuracy to another decimal or two, but if nothing is to be gained in the operation of the finished product, the customer should not be made to wait or pay for this extravagance.

Inspection has come into being as an accepted step in manufacturing, for parts which must fit one another are often made in adjoining states rather than in adjoining rooms. The tools of inspection are so highly accurate that there is no clear cut demarcation between right and wrong. A dozen correct answers and infinite incorrect ones are separated by a zone where the decision to accept or reject is made only by human judgment.

The manufacturer is usually required to shoulder the entire burden of inspection, but if he happens to be building a Diesel submarine engine, he finds the United States Navy a most cooperative customer. Before sending out a submarine on its war-winning mission, the Navy

will test and inspect and test again, and it is sound planning to do as much of this as possible at the factory.

The Naval Inspection Service had its beginning with the first Federal naval shipbuilding program, as authorized by an act of Congress on March 27, 1794. To be built were six United States frigates, including the historic Constitution, and ship captains and other officers were appointed to inspect construction, materials, ordnance, accessories, equipment and naval stores. This service has continued without lapse, keeping pace with the changes from wood to steel and from sail to steam turbine, oil engine and high-power electric motor. It has made notable contributions to naval architecture, engineering, ordnance, radio, and aeronautics.

Navy Inspection blankets the general industrial field from headquarters established in the focal points of raw materials and manufacturing concentration. It is staffed by line officers, though the actual work of inspection is performed by civilian employees under Civil Service. Schools are maintained at a few points for the training of inspectors, and as in other branches of industry, many women are now employed in this work.

For instance, raw materials coming to the Fairbanks-Morse factory at Beloit are stamped with the approval of this outside Navy Inspection system, but the responsibility for turning out submarine Diesels in generous quantities has dictated the wisdom of an independent Navy

Inspection Department at the Beloit factory which is answerable directly and only to Navy Headquarters in Washington.

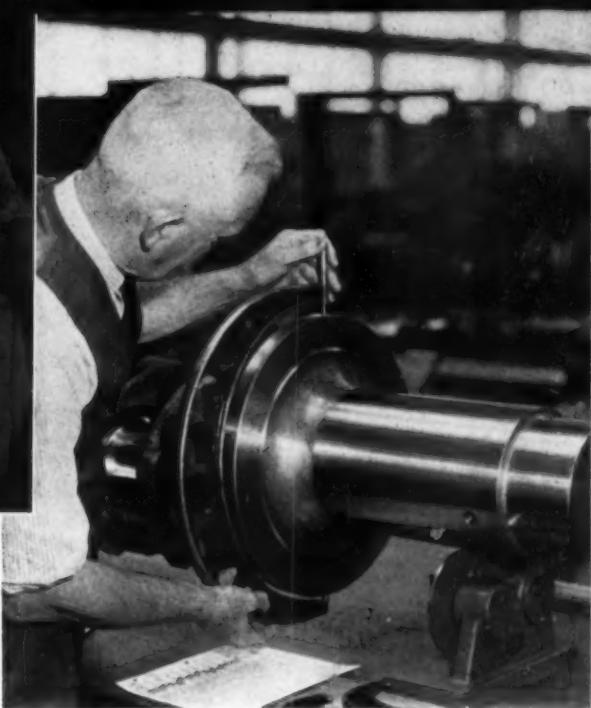
Commander J. M. Hicks, USN, heads this organization. His modest title is Inspector of Machinery. His duties include the supervision of all branches of Navy Inspection as well as the Navy Training School Beloit, to which officers and enlisted men are assigned for a six-week's course of study to familiarize them with the construction and use of the Fairbanks-Morse opposed-piston Diesel engine.

Under Commander Hicks, the responsibility divides into specialized channels. Lieutenant R. S. Norris, USNR, is Officer in Charge of the Inspection Division. The Engineering Division is similarly headed by Lieutenant R. E. Wright, USNR, the Progress and Expediting Division by Lieutenant R. C. Kravik, USNR, and the Materials Division by Lieutenant R. A. Martens, USNR. Lieutenant E. J. McCleary, Jr., USNR, is Office Superintendent. Less obvious duties of the staff include plant protection and investigation of visitors, labor and selective service relations, and assistance in fitting the Fairbanks-Morse program of research engineering on engines to the exact needs of Navy ships.

Next under Lieutenant Norris in the Inspection Division is civilian Supervising Inspector R. S. Boaz, and responsible to Mr. Boaz are the thirty or more civilian men and women who perform the routine inspection duties. Most are assigned to fixed stations around the plant, and their



Small shaft has tensile strength of approved standard as shown by test.



A submarine Diesel crankshaft mounted on dynamic balancer is being checked with giant "mike."

BUILDING DIESELS FOR SUBMARINES

work parallels the task performed by about ten times the number of inspectors employed by Fairbanks-Morse. For the most part, trouble is discovered by the Fairbanks-Morse group. Only the large and the borderline cases come to the attention of Navy inspectors, and where there is a question of doubt, the lower court verdict is mostly "reject."

If the irregularity involves the loss of a large and valuable piece of equipment, the matter is referred to a "salvage meeting" attended by ranking officials of both the Company and the Inspection Office. All parties consider carefully the reason for rejection. Can the failure of the part to come within the limits of blueprint tolerance be corrected by added machining? Has the milling uncovered a structural weakness? Has the milling created a structural weakness? Is the fault in such a place that the operating efficiency of the engine may not be affected? Can the part be salvaged for some less vital source of power than the engines of a submarine or destroyer escort?

The responsibility for such decisions is grave. In the war effort, quality must not be slighted, and at the same time there must be no waste of critical material, machine hours and skilled manpower. Whatever step is determined, it is a sober, responsible and unbiased opinion by all who take part. It is impossible to predict who will argue for acceptance and who for rejection. This is an ideal setting for the administration of true justice, and it rarely produces a wrong answer.

Inspection is mostly a dull and unglamorous subject to talk about. The visitor to the plant is hardly likely to see more than an unbroken succession of acceptances. It is like watching an expert game of billiards. Every shot is so nearly perfect that the next one is too easily made to be interesting. It is the rejection, however, that makes the news, and care must be taken to avoid the impression that rejections are a commonplace occurrence—which definitely they are not.

The Navy's seal of acceptance is administered with a small die and a hammer to some appropriate surface of each approved part. These parts gravitate in an unbroken stream to the erecting room, where a number of inspection stations provide check on accuracy of assembly.

Here the crankshaft is given a final test and stamp of approval. The scavenger blower is tested for backlash and proper clearance of impellers. The assembled engine is given a water test for leaks in the cooling system, and then it is picked up by a giant crane and deposited gently in some vacant berth in the long line of roaring monsters undergoing the ordeal by fire—the all-important performance test.

For prescribed hours and at varying speeds each engine is run, and its temperature, its developed horsepower and its consumption of fuel and lube oil are carefully studied and compared with the performance standard. When the test run is completed, the engine is still not finished. There is another water test to disclose fittings



Partly assembled engine is "plugged" and subjected to hydrostatic test for leaks.

which may have vibrated loose, and piston units are disassembled to study the effects of the trial run-in on cylinder walls and bearings.

Now it is complete. Once more reassembled, it is given a final stamping with the little hammer and die, and all that remains is to coat it with protective oils and paints, load it on a flat car, cover it with a waterproof canvas and send it on its way to the shipyard.

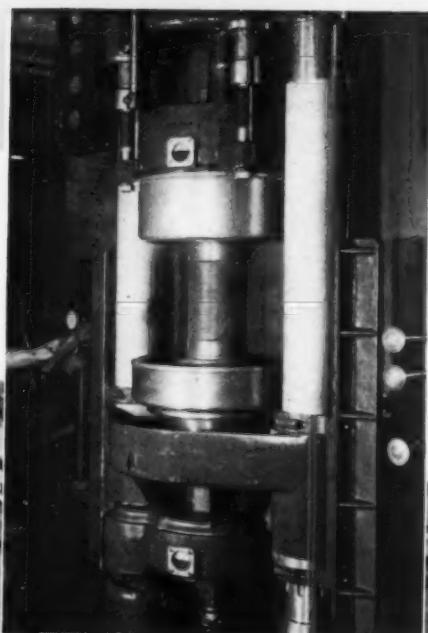
The obvious purpose of inspection is to find and bring about the correction of deviations from standard. There is a secondary accomplishment none the less important. The men and women who build the engines in this atmosphere of constant watchfulness can not but help reflect it in the painstaking care of their own efforts.

INDUCTION HARDENING

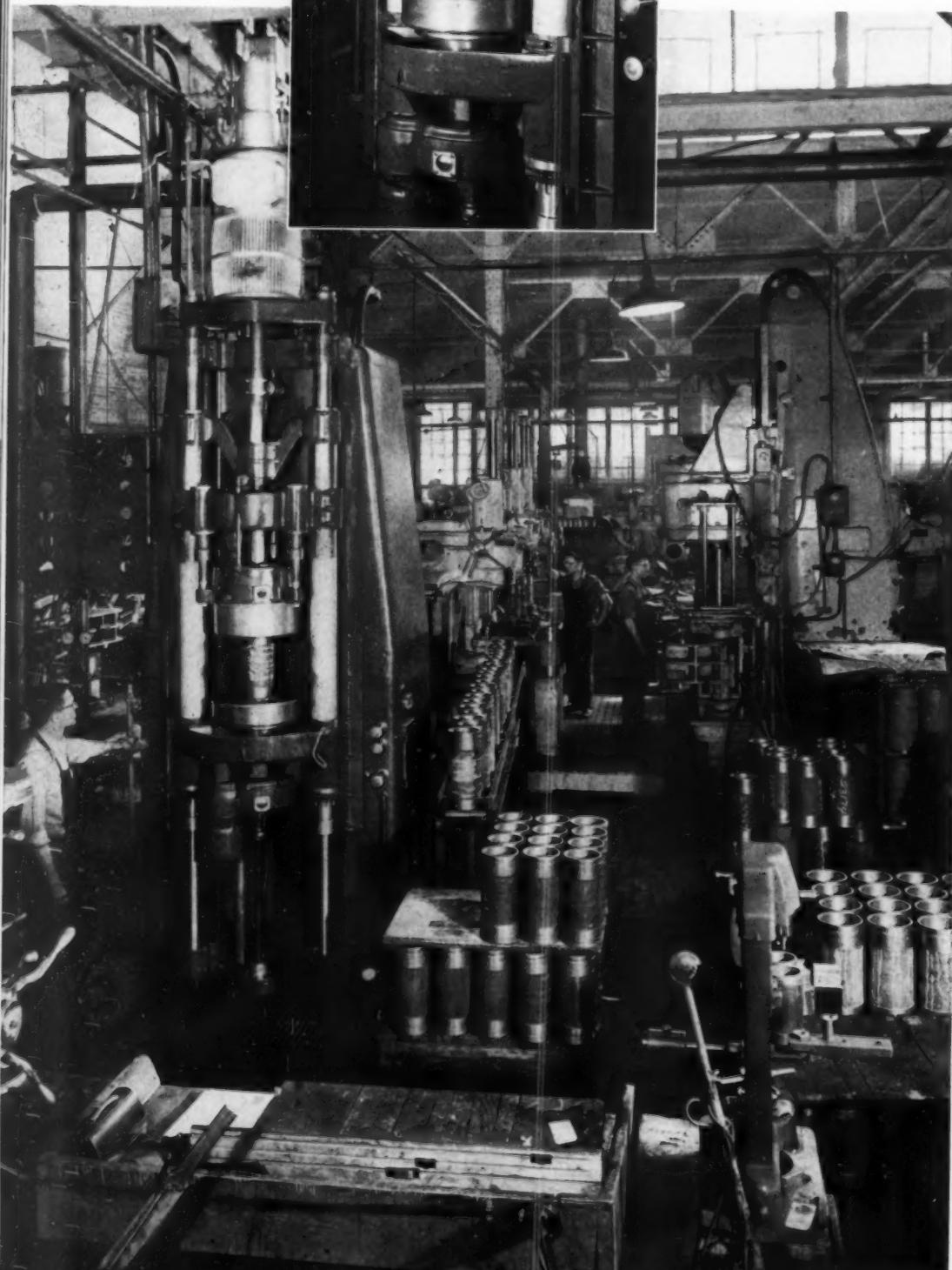
A REAL NICKEL SAVER

By WILL H. FULLERTON

Right: Cylinder liner being revolved during hardening process in Budd Induction hardening machine.



Below: View looking up the cylinder liner production line in the Caterpillar plant. Budd induction hardening machine in the foreground.



A PIONEER in precision hardening actually, Caterpillar has been saving metals by the high-frequency induction method since 1938. Since that time, Caterpillar Tractor Co. has expanded this process more than 100 times, particularly during wartime production of war materials, thus effecting a substantial conservation of critical metals.

Back in 1938, Caterpillar installed the first continuous-type induction hardening machine ever built in order to harden its track-type tractor track pins to a greater depth—and to a greater percentage of total depth. This was hardened—than was available by any other process. The source of power was an avoidable

Now the company has 16 complete induction hardening units scattered through its production lines and has extended this process to include cylinder liners, final drive gears, heavy shafts, drawbar pins, push rods, accessory and other shafts. Formerly made of nickel steel and nickel chromium steel, they are now made of carbon steel, hardened by the induction process. Right now the conversion of a 3½% nickel steel final driver gear on the Caterpillar Diesel D8 Tractor, largest model built in the plant, to a plain carbon steel, is alone saving 144,000 pounds of scarce nickel every year. This major conversion of an important part, the final link in the chain of power between the engine and the main sprocket that meshes into the track chain on the 17½-ton machine, involved a 3-year development program costing \$500,000.



hardening actually, less than 200 tons of nickel were used in the first production method. Caterpillar Tractor Co. in 1942 compared this production with more than 450 tons previously used—a figure that, without conversion, would have reached more than 600 tons per annum at the current rate of production.

In adopting changes in design and especially changes in materials used in its products, the company has been in a most favorable position by reason of a company policy, long pursued. This was a program of avoiding the difficulties that might arise from dependency on a single source of supply, except in cases where this was unavoidable, by studying and doing research and experimental work on alternative materials.

For instance, it was recognized that the entire world supply of nickel comes from a source outside of our own country. Thus a plan of action was prepared in case that metal became unavailable or difficult to obtain. The same policy has been followed in the case of other metals now made of nickel steel and other materials now on the critical list.

Many persons, reading reports from European countries regarding the sacrifices of quality that have been imposed by the adoption of "ersatz" materials, have the impression that changes in design and materials always mean lessened quality. But it is a triumph of American ingenuity involved in scientific skill that a program such as is being carried on at Caterpillar Tractor Co. in

volves in most cases no sacrifice of quality and in numerous instances has resulted in improvement of the product.

"Two objectives have guided our program of critical material conservation," a company spokesman says. "First: to carry to the farthest practical limit the elimination of critical materials from our products; second: to avoid sacrifice or in case of extreme necessity to make the least possible sacrifice of the quality that has made the name 'Caterpillar' represent outstanding performance in the hands of users."

In planning the conversion of the nickel steel final drive gear to plain carbon steel it was necessary to install new equipment, as all the equipment on hand was designed for rather small parts of cylindrical contour and operated at the more-or-less standard frequency of 3,000 cycles per second.

At the time, Budd Induction Heating Co. of Detroit was engaged in a development wherein the bore of a wheel hub was being heated by an inside inductor rather than its outer surface by a surrounding inductor. This required to a striking degree the surface effect Caterpillar was seeking. For that purpose Westinghouse had built electrical equipment rated at 500 kw. 800 volts, 9600 cycles, and through the cooperation of H. E. Somes, chief engineer, Caterpillar was able to use this power plant long enough to

prove that 9600-cycle current would give a sufficiently uniform heat effect along the surface of the teeth.

Duplicate equipment was ordered for the Peoria plant, consisting of an 800-h.p. motor, direct connected to a high frequency inductor generator, both hydrogen cooled to reduce size and improve efficiency. It runs at 3600 r.p.m., such high speed being about the safe limit for the centrifugal forces generated in a rotor of required size. Four banks of capacitors are installed alongside to improve the power factor, and clever control equipment, housed in a steel cabinet, insures an automatic regulation of current at all times during the heating cycle by adjusting the current in three steps as the metal in the gear's surface passes through the transformation range and loses its magnetism.

From a test standpoint, the old alloy steel gears were pitted after 100 hours at full load while the new gears will operate for 3,000 hours under the same conditions. At the end of the time the fine marks left by the shaving tools are still clearly visible.

Caterpillar not only used the first continuous-type hardening machine ever built in manufacturing track pins, but was among the first companies to use induction hardening for cylinder liners. It is believed to be the very first to apply the process to final drive gears.

Left: Tocco induction hardening unit for flanges on tractor track roller shafts.

Right: Induction hardening equipment including two track pin hardening units and a shaft hardening unit, all Tocco.

Left: Westinghouse 500 kw. hydrogen cooled generator for Tocco hardening machine.



DEVELOPMENT OF CAST CRANKSHAFTS FORECASTS HUGE SAVINGS IN ENGINE BUILDING

THE technical progress being made in American industry under the stresses of wartime production is strikingly demonstrated at The Cooper-Bessemer Corporation where recently released information, shows results obtained in exhaustive tests for replacing engine crankshafts of forged steel with cast Meehanite crankshafts. Some of the benefits to be realized from these tests foretell unprecedented savings in critical steel and in the conservation of time and skilled labor. The company has maintained its steady program on crankshaft construction during the entire period of wartime expanding production. A comparison of the methods and materials used to produce heavy-duty engine crankshafts brings out the unusual savings that can be effected in modern casting procedure over conventional methods. In a type LS Cooper-Bessemer 8 cylinder marine Diesel engine, for example, the steel ingot from which the crankshaft is block-forged weighs 36,000 pounds, but the completed shaft weighs only 12,000 pounds.

In this instance which illustrates a typical comparison between foundry castings and block forging, two thirds of the original weight of metal, or 24,000 pounds of critical steel, must be removed by various machining operations. Not only is the saving in steel of particular significance, but the elimination of costly sawing, chipping, drilling, turning and boring saves many man hours, permits delivery schedules to be met in far less time, and releases skilled workers for other important duties.

According to L. F. Williams, Cooper-Bessemer executive who has devoted considerable time to promoting experimental activities of the company, a series of exhaustive laboratory and

running tests were conducted which proved that cast crankshafts could not only be produced successfully but that they were also eminently practical for many engine designs. In order to compare the characteristics of the two types of shafts a fatigue machine, of a size capable of handling a complete multi-throw crankshaft was constructed. The success of cast crankshafts was indicated from the outset when the first shaft selected for testing—a two-throw cast shaft with 4½ in. diameter pins and journals and with counterweights cast integral, was tested in a 7 in. by 9 in. two-cycle gas engine.

Results of these tests indicated the feasibility of replacing the steel forging with a Meehanite Metal casting without modifying crankshaft dimensions for engines of this particular design. Twelve of these cast shafts were produced and assembled into engines going into the field during 1936, two years after Cooper-Bessemer acquired a license to process iron under Meehanite patents. The success of cast Meehanite crankshafts was forecast during the ensuing period as all shafts performed satisfactorily and not one has broken.

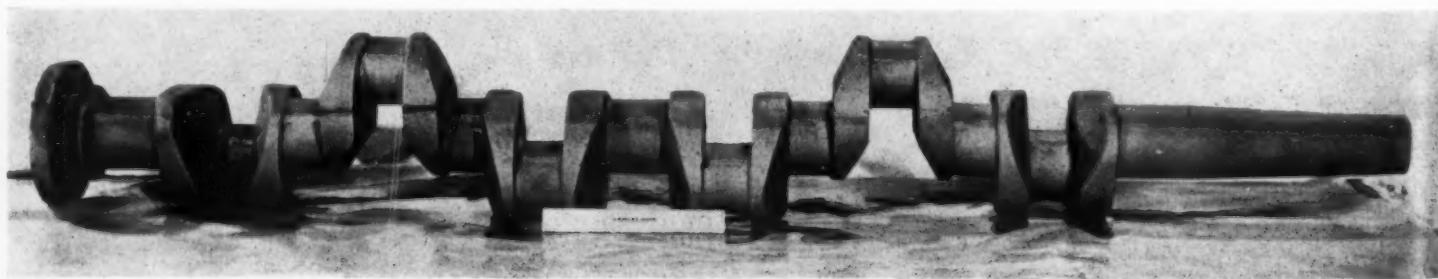
Continuing the progressive development and research program along the same lines, Cooper-Bessemer conducted a series of similar tests on relatively larger cast crankshafts, which are still being carried on at the present date.

Just recently Cooper-Bessemer conducted its most spectacular test using a 6-throw shaft casting, 7 ft., 8 in. long, with 5½ in. pins and journals to replace the forged steel shaft in an 8¾ in. by 11 in. Diesel engine. First, the engine was operated at 900 pounds peak pressure for

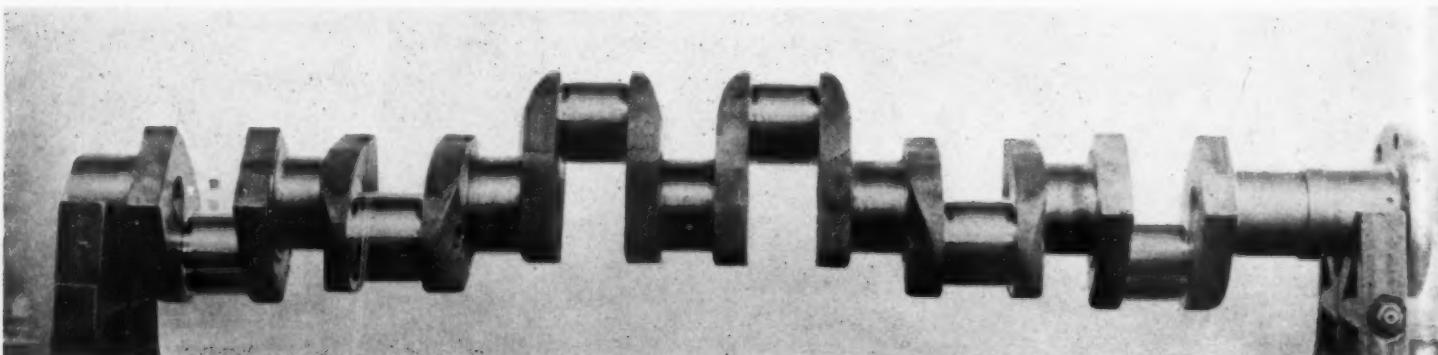
20,000,000 revolutions at 900 revolutions per minute. When the bearings were removed and whiting applied, no distress was apparent in the shaft. During the next phase of the test, 20,000,000 additional revolutions were run at 900 revolutions per minute and 1000 pounds peak pressure. Bearings were again removed, whiting was applied, and the shaft was still in perfect condition. Engineers, in a determined effort to break down the engine, then operated it continuously in a peak critical test for six days. During the night of the sixth day, a change in operating efficiency indicated that the shaft had finally failed.

Although the engine was operated for 12 hours after all indications had pointed to a cracked shaft, a subsequent examination showed that this severe test, despite the additional running time, had caused a fracture extending only half way through the shaft and it still continued to function, attesting to the strength and high endurance of Meehanite metal.

All tests outlined were conducted with crankshafts of "as Cast" process A Meehanite, stress relieved but not heat treated. In these tests forged shafts of .45 carbon steel with a minimum tensile strength of 80,000 pounds per square inch, were removed from assembled engines and replaced with cast Meehanite shafts. Pin and journal diameters, and crankweb thicknesses were not changed. In commenting on results of these tests, Mr. Williams said, "While a full interpretation of these and similar test results cannot be given at this time, we believe we have learned where, how, and why the type of material we have developed can be employed in crankshaft design with complete confidence."



Above: A cast Meehanite metal crankshaft, 7 ft. 8 in. long, weighing 1340 lbs. Below: Semifinished shaft; finishing reduces its weight only 940 lbs.



TS



AUTO-LITE has applied to the development of electrical systems for Diesels the knowledge and experience gained through thirty-two years of building automotive electrical equipment. The dependability of these units is responsible in large measure for Auto-Lite's leadership as the world's largest independent manufacturer of automotive equipment.

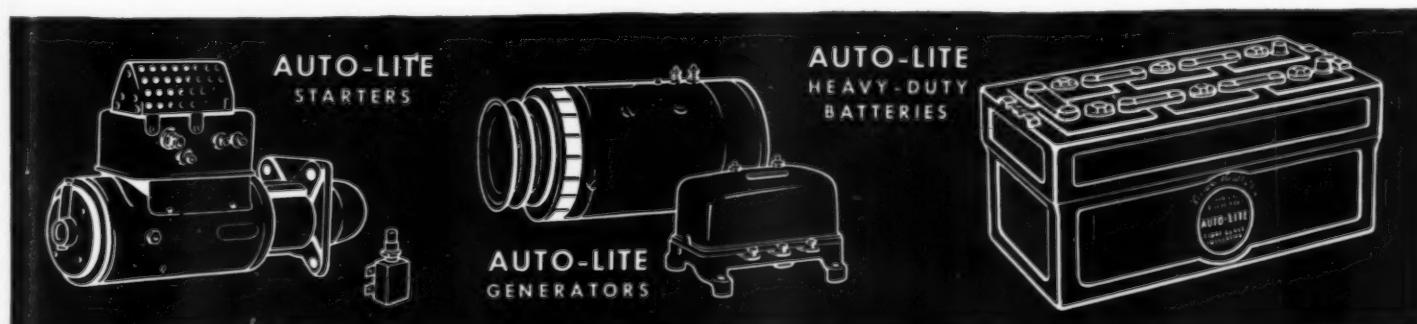
Auto-Lite systems for Diesels are com-

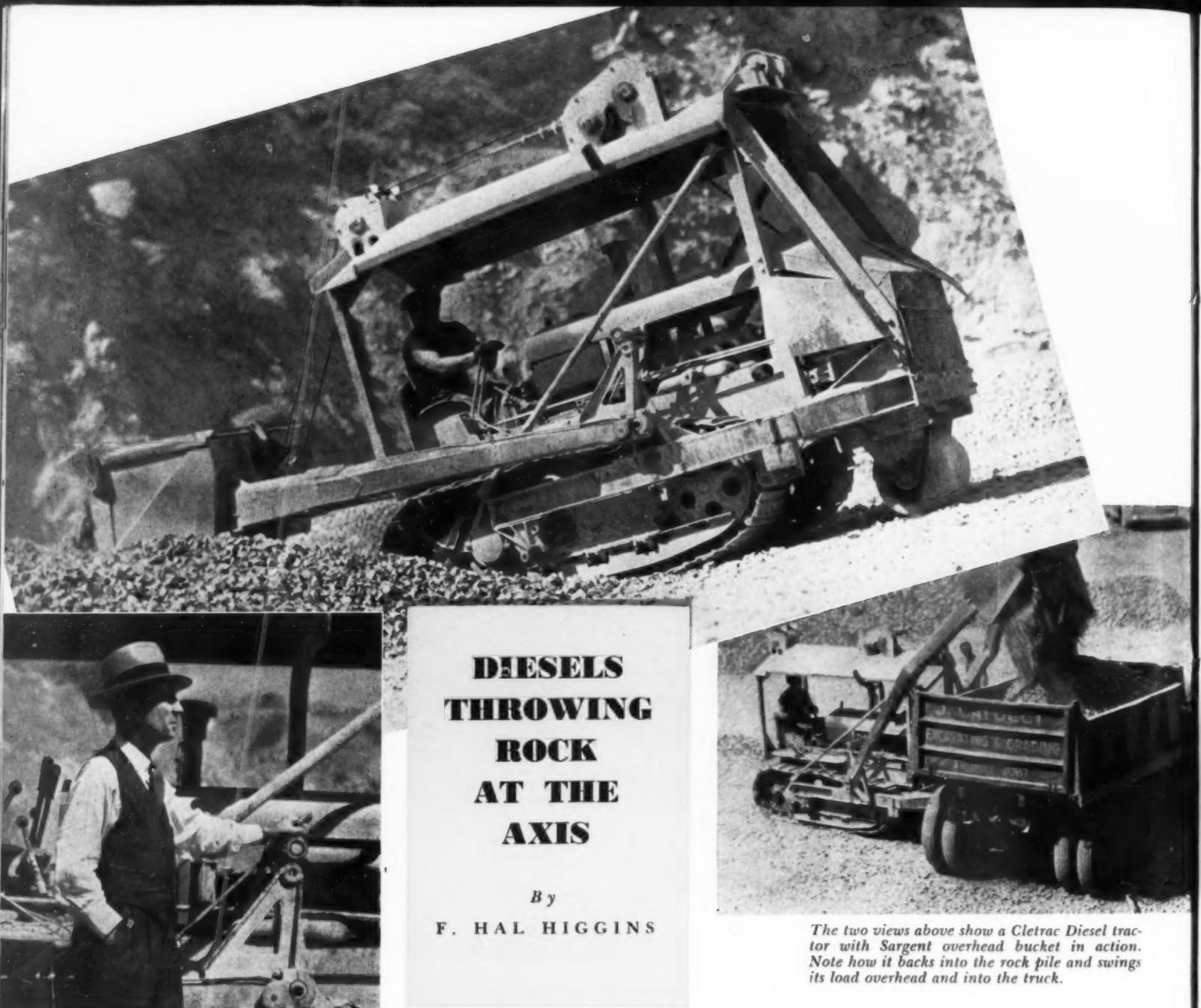
plete from generator to voltage control to battery to starter. These units are part of a long list of items Auto-Lite's 26 great manufacturing divisions are producing for America's Armed Forces on land, sea and in the air. Diesel manufacturers are invited to consult us on problems involving electrical cranking or generating equipment.

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DIESELS THROWING ROCK AT THE AXIS

By
F. HAL HIGGINS

President Frank D. Moller of Superior Rock Co., Oakland, Cal.

DON'T let the war correspondents and radio war reporters see the Diesel Cletracs wearing Sargent overhead scoops or they will drop their "Bulldozers" and start calling tractors "buckets"! This combination powered by Hercules Diesel engines have suddenly become the sensation of the West Coast in rock quarries, gravel pits and in any other tight spots where a bit of tidy scooping and loading is needed. Already Henry Kaiser has ordered some five of these Diesel Cletracs with Sargent overhead buckets for his gravel pits, quarries and the world's record 10-mile conveyor belt at Redding that feeds gravel over the hills to Shasta dam. The pictures here show the Superior Rock Com-

pany quarry just off Broadway in Oakland, California. This is an old quarry that has been in use off and on for more than forty years, says Frank Maldonado, Cletrac dealer at San Leandro, who worked out the application of Diesel Cletracs to such odd jobs. Frank is an ex-Best and Caterpillar man with a lifetime of tractor building, selling and servicing that has taken him all over the world until he settled down as a dealer after returning from South America a few years ago. Being at the bottom of a depression he immediately began figuring out overlooked jobs for Diesel tractors and found the San Francisco Bay area full of them in spite of all the competition.

The two views above show a Cletrac Diesel tractor with Sargent overhead bucket in action. Note how it backs into the rock pile and swings its load overhead and into the truck.

"The big advantages of this Sargent bucket on the Cletrac Diesel here are—1. It's straight back and forward operation doesn't ruin a lot of rock, as do other overhead bucket-mounted tractors," says President Frank D. Moller of Superior. "2. Speed of loading; we get as high as 700 tons a day of 8 hours when used constantly.

"We have had this outfit about a year. We are doing 100% war work, furnishing materials for camouflage paper, as well as for Army and Navy construction. It takes the place of a big \$20,000 crane that is hard to move for each truckload. It's a mobile outfit and saves two handlings of much material."

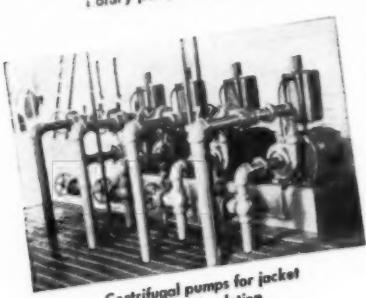
FOR UNINTERRUPTED POWER SERVICE



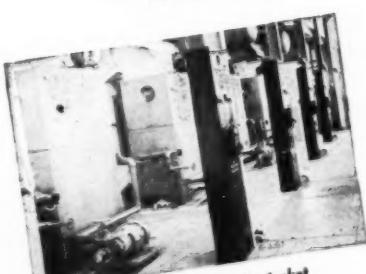
Air compressors for starting



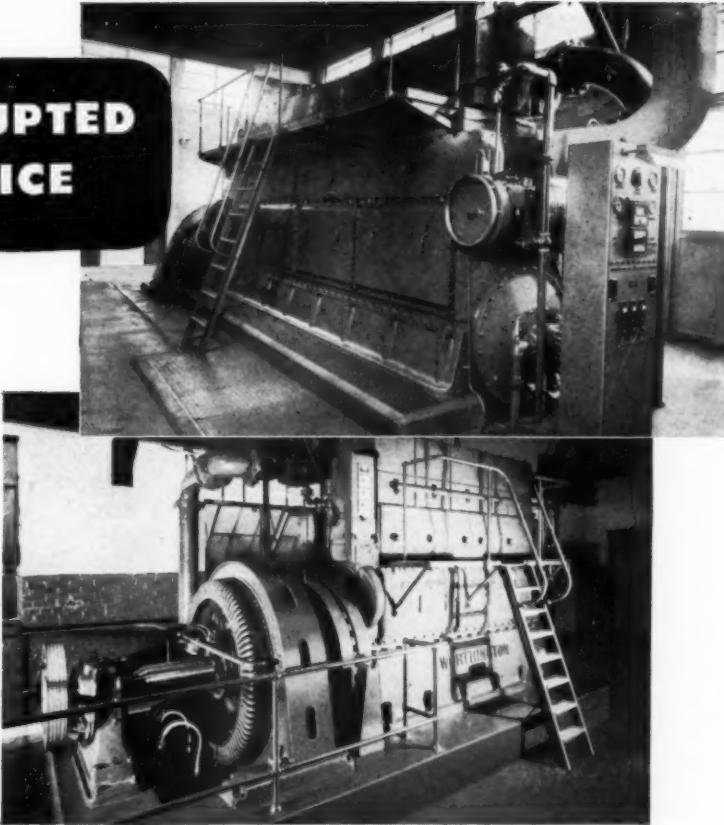
Rotary pumps for fuel-oil transfer



Centrifugal pumps for jacket water circulation



Evaporative coolers for jacket water cooling



The outstanding reliability of Worthington diesel and gas engines is a matter of definite record in hundreds of installations, and in a wide variety of applications. They are giving unbroken performance—with high operating efficiency—over long periods of continuous service.

And, all Worthington auxiliaries . . . air compressors for starting, rotary pumps for fuel-oil transfer, centrifugal pumps for jacket water circulation and evaporative coolers for jacket water cooling . . . give additional service security through the undivided responsibility of one maker.

Thousands of horsepower of Worthington engines . . . in Army and Navy bases, ordnance plants, industrial and municipal power plants . . . are now carrying important parts of the United Nations' war power load.

DIESEL ENGINES

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SUPERVISING & OPERATING ENGINEERS' SECTION

"CYLINDER HEADS"

*Conducted by R. L. GREGORY**

THE primary object of the editors of DIESEL PROGRESS, in allotting this space to the Superintendents and Operating personnel, is to provide therein, items of interest relative to operating and maintenance questions and problems and to obtain from our readers in so far as possible, their reactions and comments on the subjects discussed.

In the November issue, the writer discussed a means used for the temporary repair of a leaky gasket between the cylinder liner and the block. We have received several letters on this subject, and while neither time or space is available in this issue, we will print and discuss some of these letters in the January issue, under the Maintenance Section of the magazine.

In this issue the writer would like to present the subject of "Cracked Cylinder Heads" because of late we have had more than the usual amount of correspondence on this subject, and we hope that our readers will feel free to give their comments and experiences on this subject.

Of late we have heard considerable about the subject of cracked cylinder heads and the writer feels that there may be several causes for interest developing in this subject. First, there are many more Diesel units in operation in this country at the present time than there ever have been before, and with more units in operation, it naturally follows, that there will be more breakdowns and maintenance to this type of equipment. This is in all probability due to a limited time of outage for maintenance, due to our war effort, and many plants are unable to allot outage time, that ordinarily would be available due to load conditions on their plants.

Secondly, due to increased load conditions, many units are operating at or even above full rating, with the result that increased strains and stresses are being put on the units. These conditions all play an important part and have their effects in daily operation of your units.

All Diesel units are designed with certain allowable stresses and strains and a marginal safety factor for normal operation, the same as any other power plant equipment. This takes into consideration the factor of expansion and con-

* Chief Engineer, Municipal Water and Light Plant, Hillsdale, Michigan.

traction and the unit is manufactured of metals which will conform to these specifications. Now if you are forced to operate a unit under such load conditions, that you exceed this allowable factor due to increased temperatures, etc., it follows that eventually any weakness in materials will begin to make itself known. The temperatures at which your units operate is determined in the most part, by load conditions and cooling agents and systems, presupposing that the unit is in good mechanical condition and that fuel and lubricants are suitable. Now suppose that load conditions and demands are such that you must operate your units at excessive load, which will increase temperatures, or suppose that your units are operating on widely fluctuating loads, fully loaded for a few moments and then only partially loaded for the next period, causing fluctuating temperatures.

Such operation has its direct effect on expansion and contraction of the metals and unless you have an ideal cooling system, with plenty of cooling agent, properly controlled, these stresses and strains will vary to such an extent that any weakness in construction will eventually show up.

We are all aware that any internal combustion unit will give more satisfactory results from an operating standpoint, and I refer especially to Diesel units, when they are operated well within rating, on more or less of a steady load, and operated continually during the operating period. Large fluctuations in load, with their attendant temperature changes, and the attendant temperature changes on units frequently started and stopped are not conducive to minimum maintenance costs.

We are also all aware of the inability of Manufacturers to supply us with replacement parts of metallic analysis, such as we were accustomed to in normal peace time operation. Consequently we are sort of placed behind the eight ball, if we expect such parts as cylinder and piston heads to stand up with prewar equipment.

Even though the metallic content may be satisfactory, there is the problem of seasoning which must be taken into consideration. In normal peace time, manufacturers were able to carry large excess stocks of castings which they took from the foundry, stacked them outside and let

them season for months before annealing and machining. With the present day methods of operation, scarcity of materials, etc., even though metals are treated to improve seasoning, many are taken directly from foundries, annealed, machined and shipped to some customer in great need. The metal is green and consequently will not stand up under increased strains as will well seasoned castings. The writer believes that much of our present day metal failures may come from this cause.

Replacement of cracked cylinder heads is costly maintenance. There seems to be a great variance of opinion upon the feasibility of trying to weld up and repair cylinder heads. Many engineers claim that it is feasible and there are plants which make a specialty of this sort of work, claiming that heads so repaired are even stronger and better than many original castings.

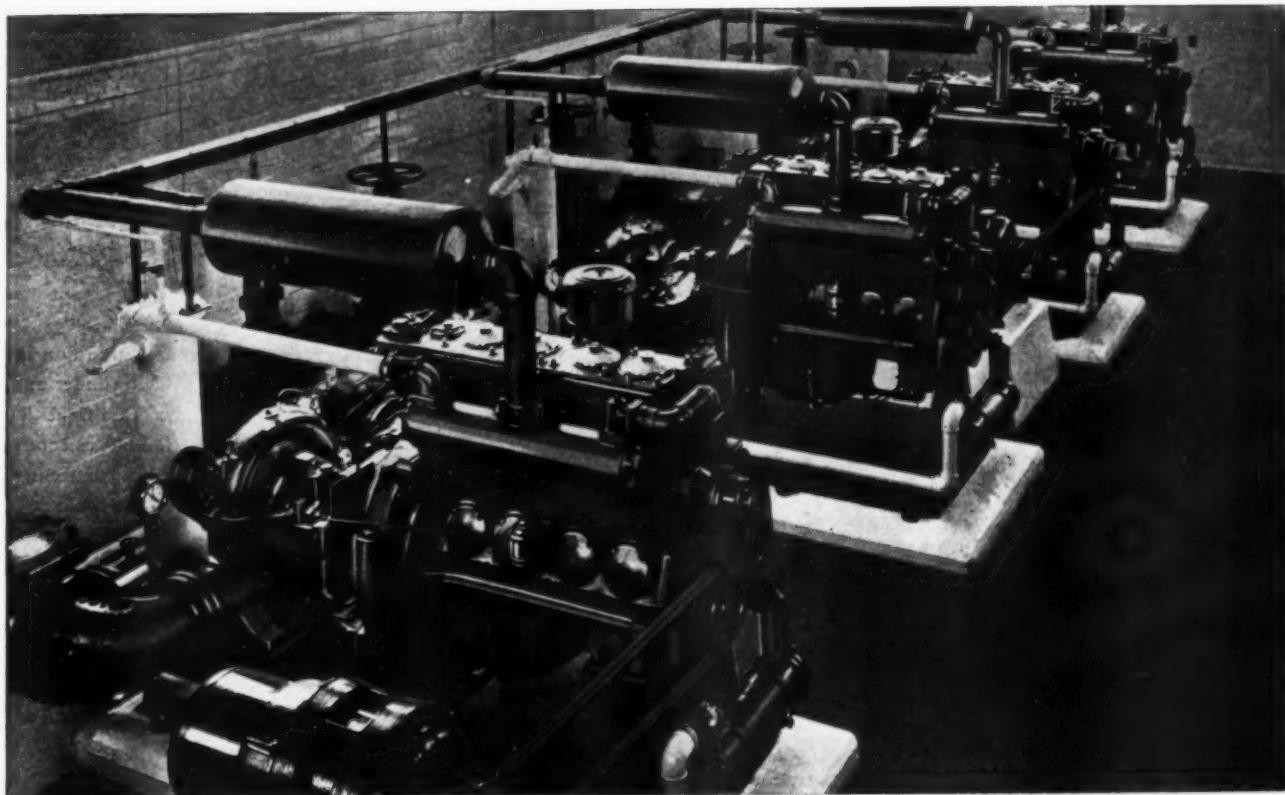
The writer is aware of instances where this has been accomplished and the repaired heads have given years of service, but he is not aware of instances where this has been accomplished on large units. In the case of smaller units where this has been satisfactorily done, great care has been exercised in the process of welding. The vital points being to properly preheat the casting to be welded and in welding to use the proper materials in order that expansion and contraction may be kept as near uniform as possible.

We are therefore asking that any of our readers having had experiences with cracked cylinder heads, who have attempted or succeeded in welding large cylinder heads, kindly give us their reactions on this subject, both as to the cause of the cracking and the method of satisfactorily repairing the damaged part.

Of course it is possible to crack a cylinder head if the head is not properly installed and pulled down. And we all know that it is vitally essential to keep the cooling chambers free from scale and corrosion in order that the proper amount of cooling agent may be circulated.

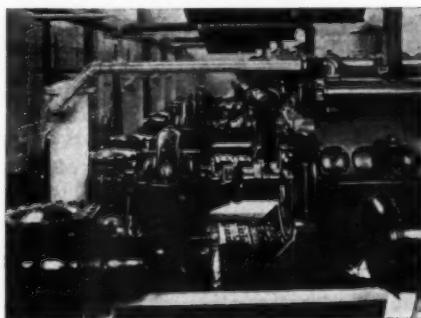
What we are vitally interested in is the experiences of those, who have had this trouble knowing that the mechanical condition did not have any part in the trouble which caused the cracked heads.

ION



LOW COST WATER from HIGH-EFFICIENCY PUMPING STATION *Powered by* MURPHY DIESELS

Four "ME4" 90 BHP (continuous rating) Murphy Diesel Engines, with electric starters, filters for fuel and lubricating oil, hydraulic Servo-type governors, automatic safety controls and heat exchangers . . . direct-connected to Morris Centrifugal Pumps, 10" section, 8" discharge, 1750 GPM at 130' total discharge head, 1150 to 1200 RPM . . . assure uninterrupted 24-hour water pumping service for New London, Connecticut, under all conceivable conditions or emergencies.



BUY
U. S. WAR
BONDS

MURPHY DIESEL ENGINE SIZES: 90 to 215 HP;
GENERATOR SIZES: 60 to 115 KW, AC or DC..
MARINE ENGINES: 90 to 165 HP, with 1:1, 2:1, 3:1
reverse and reduction gears. WRITE FOR BULLETIN.

At a fuel cost of less than $\frac{1}{2}$ cent per 1000 gallons of water pumped, MURPHY DIESEL engines (operating at the high efficiency of 90%), direct-connected to high grade centrifugal pumps, lift water 120 feet up from Konomoc Lake to fill the three standpipes (half million gallon capacity each), from which New London, Connecticut, now draws its water supply.

Power for 24-hour per day pumping is assured by this Murphy Diesel installation . . . the most outstanding pumping station of its type on the Atlantic Coast!

This low-cost, high-efficiency operation is typical of dependable Murphy Diesel performance on a wide variety of installations. Among other advantages, the Murphy Diesel Unit Type Injector design permits removal of the complete assembly of each engine intact, for examination.

Write for complete details and bulletin.

MURPHY DIESEL COMPANY
5317 W. BURNHAM ST., MILWAUKEE 14, WISCONSIN



For Excellence in
production of Diesel Engines



More Power
More Profits with

Exchange Your Diesel Maintenance Ideas

"Keeping Main Bearings Tight"

Conducted by R. L. GREGORY

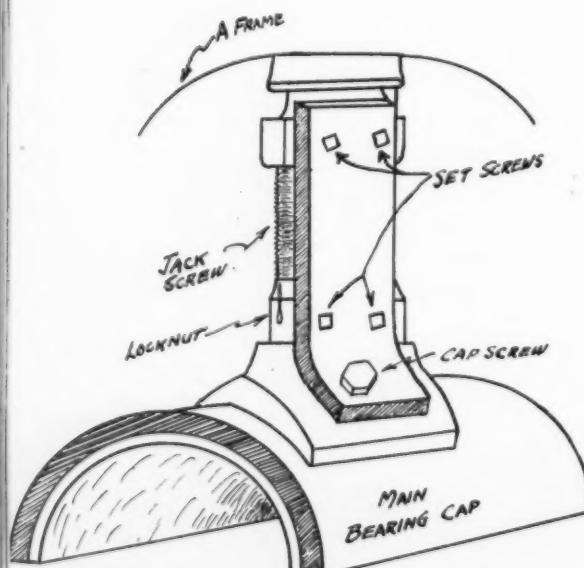
Editor's Note: In this department we provide a meeting place where Diesel and Gas engine operators may exchange mutually helpful maintenance experiences to keep our engines in top condition. Mr. Gregory edits your material and adds constructive suggestions from his own wide experience. This is your department—mail your contributions direct to DIESEL PROGRESS.

ABOUT three years ago, we purchased a new 500 hp., Model D.F. Diesel unit for our Municipal Power Plant, and after operating this unit about a year we found difficulty in keeping the main bearings tight.

"These bearings are held in the 'A' frame by means of jack screws which bear down on the bearings from the top of the 'A' frame. Although we run periodic inspections, each time they were inspected we found one or two of these jack screws loose, especially the one on the end of the shaft away from the flywheel.

"The accompanying sketch shows how we overcame this trouble. We inspect these bearings every two weeks and since making these repairs we have never encountered any further trouble.

"A piece of strap iron $\frac{3}{4}$ " thick by 2" in width was fitted as shown in the cut, to the top of the bearing cap and held in place by a set screw. Two more were placed at the bottom of the jack and two against the lock nut. The reason for this was so that one set screw would bear on one of the facets of the two nuts, regardless of where they were turned when tightened in position."



The above maintenance point was submitted by Mr. Didier, engineer in charge of the municipal plant at Osage City, Kansas and shows how he overcame the problem of loose main bearings. Mr. Didier did not state whether he ever found the cause for the loosening up of these jacks. His repair certainly should have held them rigid and in place and solved his problem. He might have been able to accomplish the same result by using a heavy pall nut, above the lower nut and another, below the upper nut, and locking the pall nuts tightly in place.

Molecular Action In Internal Combustion Engines

THE following article sent in by Mr. Gus Berglund, inspector for the Fidelity and Casualty Company, while not pertaining to Maintenance, is an interesting explanation of the action of the molecules of air in combustion within Internal Combustion Engines and explains why this molecular action makes the Diesel the more efficient unit.

In the discussion of the process of combustion in an internal combustion engine, such as the Diesel, to fully understand just what occurs, we must go back to the subject of molecules. What is a molecule? A molecule is a minute particle of matter about seven ten-billionths of an inch in diameter. Every bit of matter in the world is constructed of molecules, air, water, solids, vegetation, earth, etc. In other words molecules are the tiny bricks, which nature has used in constructing the universe.

All molecules are in a constant state of motion, like a swarm of angry bees, and at normal room temperature and normal atmospheric pressure, each molecule travels at an average speed of one thousand miles per hour. As you sit reading this article, you are constantly being bombarded with molecules of air. Whether free or confined, these molecules of air are still in a constant state of motion. If they are confined as in a cylinder of an internal combustion unit, they are constantly striking the walls of the cylinder, the bottom of the cylinder head and the top of the piston.

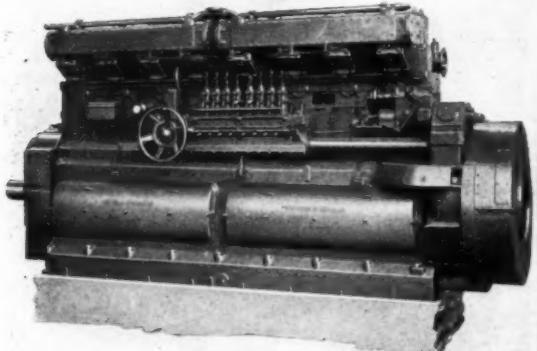
Now let us apply this instance to a Diesel unit wherein the walls of the cylinder and the bottom of the cylinder head are rigid. The piston is also of solid material, but as connected to a crank shaft, by means of a connecting rod, any force developed within the confines of the cylinder would react upon the piston. With this condition in mind, and the piston at bottom stroke, let us just follow the sequence of action of these molecules of air which are confined within the cylinder proper. Starting air is supplied to an adjacent piston at or near top stroke, thus forcing that piston down, and an adjacent piston up.

As this piston travels upward, through the cylinder filled with molecules of air, these molecules which are already in a constant state of motion are confined to a smaller space, and their rate of motion increases so that they strike the cylinder walls, bottom of the cylinder head and the piston more often. This increased pounding of these molecules of air within the confines of the decreasing space, as the piston moves upward, produces what we know as pressure, and the oftener these molecules strike the higher the pressure produced. The result of compressing these molecules into an ever decreasing area, requires work, and work produces heat.

Many examples of this statement can be thought of outside of the process of compressing air. If you take a hammer and constantly strike a piece of iron, after a few moments you will note that a certain amount of heat is being generated at the point of contact between the hammer and iron. Take a piece of wire, bend it back and forth several times, and note the heat generated by this work at the point of bending. Apply the brakes to a moving car and note that frictional heat is developed on the brake drums. This is all the result of confining the molecules of the material in question into a smaller space, resulting in a speeding up of molecular action. So with the compression of air within the cylinder of the Diesel.

When this piston in its upward movement . . . And now please turn to page 70 . . .

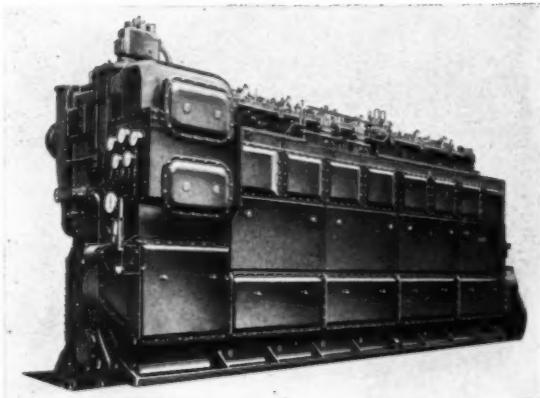
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Alco, Four Cycle, Marine Diesel Engine
(Universal Type)



Alco, Four Cycle, Stationary Diesel Engine



Alco-Sulzer Type, Two Cycle, Marine Diesel Engine

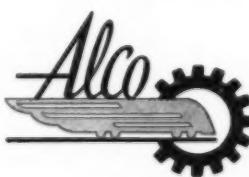
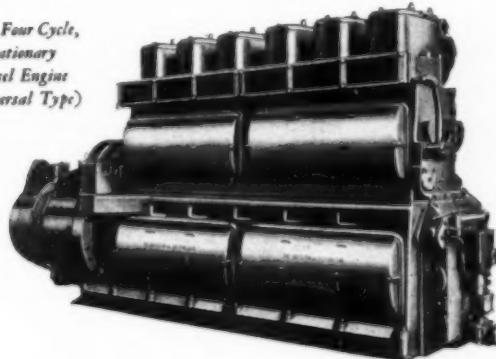
ALCO DIESEL ENGINES

Alco builds high and low speed Diesel engines of 2 and 4 cycle principle for Railway, Stationary and Marine service. Alco is therefore in a position to offer an engine that best suits any application within its field.

ALCO DIESELS				
Model	Cycle	H.P.	R.P.M.	Application
6-12½ x 13	4	660	700	RAILROAD
6-12½ x 13-T*	4	1000	740	RAILROAD
6-12½ x 13	4	540	600	STATIONARY
8-12½ x 13	4	720	600	STATIONARY
6-12½ x 13-T*	4	810	600	STATIONARY
5-17½ x 25	4	730	257	STATIONARY
6-17½ x 25	4	875	257	STATIONARY
8-17½ x 25	4	1170	257	STATIONARY
4T-14 x 23½	2	720	277	STATIONARY
5T-14 x 23½	2	900	277	STATIONARY
6T-14 x 23½	2	1080	277	STATIONARY
8T-14 x 23½	2	1440	277	STATIONARY
M6-12½ x 13	4	540	600	MARINE
M8-12½ x 13	4	720	600	MARINE
M6-12½ x 13-T*	4	810	600	MARINE
4TM-14 x 23½	2	720	277	MARINE
5TM-14 x 23½	2	900	277	MARINE
6TM-14 x 23½	2	1080	277	MARINE
8TM-14 x 23½	2	1440	277	MARINE

*Exhaust turbo pressure charged by the Buchi System.

Alco, Four Cycle,
Stationary
Diesel Engine
(Universal Type)



AMERICAN LOCOMOTIVE COMPANY
DIESEL ENGINE DIVISION

AUBURN

NEW YORK

reaches top stroke, the molecules of air are in their fastest state of motion, under extreme heat. At this point, fuel oil is injected into the cylinder in a fine fog-like spray and upon coming in contact with this hot air, immediately ignites increasing both the temperature of these molecules of air and the molecular motion as a result of the increased temperature. This results in an increase in the striking power of each molecule, which reacts upon the piston forcing it downward. As this piston moves

downward, another adjacent piston follows through with this same sequence of air compression until it reaches top stroke, and the fuel injected, ignites forcing it down, and another piston upward following through a like cycle.

As each piston moves downward after combustion has taken place, more space becomes available for the molecules of air within the confines of that cylinder, thus decreasing the molecular striking power, so that by the time the

piston has reached bottom stroke, this molecular speed or action has been expended, the spent gases are expelled through the exhaust ports, and a new charge of air enters the intake ports, ready to repeat the process or cycle all over again.

Now let us make a comparison of this action on the Diesel and that which occurs in a gasoline engine. To start out with, in the construction or design of a gasoline engine, the cylinder is filled with a mixture of air and gas. As the piston moves upward, these also are compressed, but the work required to compress the smaller number of molecules within the smaller confines of a gasoline engine cylinder, is so much less than that in the Diesel, that not enough heat is produced in the process of compression to ignite the fuel. Due to the design of the gasoline engine you are unable to speed up this molecular action fast enough to produce heat, therefore it is necessary to produce an outside source of spark, such as the spark plug, to ignite this mixture. From this point on the action in the Diesel and gasoline engines is similar.

The heat caused by combustion means that the molecules that are already in motion within the confines of the cylinder are speeded up to a terrific velocity. These molecules, like tiny pile drivers hit so hard and so often on the piston, that it is forced downward. This motion transferred to the crankshaft, keeps adjacent pistons in motion, each repeating the cycle and thus keeps the unit in motion.

With the above explanation of molecular action in these two types of internal combustion units, we have the basis for the higher efficiency of the Diesel unit. These molecules of air can be compressed so much closer in the Diesel unit than they can in a gasoline unit, that the molecular action in the Diesel unit is much greater, each molecule having a greater striking power against the piston.

If we had a Diesel unit and a gasoline unit, each with cylinders of equal size, holding the same amount of air and injecting an amount of fuel, because of the greater striking power of the molecules of air in the Diesel, the amount of work done by these molecules would not require as much fuel as that used by the gasoline unit, in pushing the piston down. In other words more fuel would have to be ignited in the gasoline unit to speed up the molecular action of the air, than would be required by the Diesel. This is just another way of saying that the engine using the less fuel to produce a given amount of work is the more efficient.



"Peace On Earth..."

These words will not always be as empty as they may sound this Christmas! One day they will again assume their full significance. And with that day will come all those fruits of peace for which the world now yearns. And just as the 4-plant facilities of The Weatherhead Company helped American industry build products like the car, the airplane and the refrigerator in the past, in tomorrow's world we will be fully prepared to help you build the post-war products you are designing today.

Look Ahead with



Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO
Manufacturers of vital parts for the automotive, aviation,
refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles
Canada—St. Thomas, Ontario

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HEMPHILL PREPAREDNESS- helps win the war with DIESELS

When the groups of Coast Guardsmen graduate from Hemphill Diesel Schools — they are ready to man and handle the Diesel Powered patrol boats that are death to our enemies and emissaries of mercy to those in distress during peace or war.



Above left: Typical high-speed Diesel used for training at Hemphill Schools. Above right: Slow speed, heavy duty Diesels are included in the training program.



Electric generating plant operation and maintenance are thoroughly studied by Hemphill students.



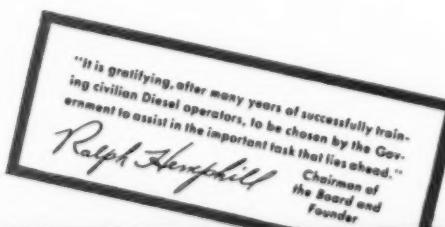
HEMPHILL DIESEL TRAINING OF COAST GUARD AND NAVY PERSONNEL *is thorough!*

Theory, yes, but classroom instruction on the principals, design and structure of Diesel engines is augmented by *actual shop training*—learning how to make small parts and to handle pipe fitting, electric wiring, and other voyage repairs. Engines and training equipment in Hemphill Schools, parallels the tools, machines and engines in actual service.

In addition, the New York Hemphill Schools' "MS Brisbane," gives Coast Guard personnel in Training there actual experience on a Diesel-powered boat. They learn ship's telegraph and bell signals, engine operation and servicing under actual ship-board conditions, how to handle fuel transfer pumps, battery systems and other equipment.

Marine, Generating and Stationary Power Plants are an open book to Hemphill-trained men. Hemphill Schools in Los Angeles, Chicago, Memphis and New York are the fountainhead of Diesel training which is *vital now* and will be valuable to these men after the war when Diesels will again be put to work for peace time power on land and sea.

Home Study Also Available—If it is not possible for you to attend a Hemphill School, you can lay the foundation of a Diesel career with Hemphill's Home Study Course. Write today for complete information.



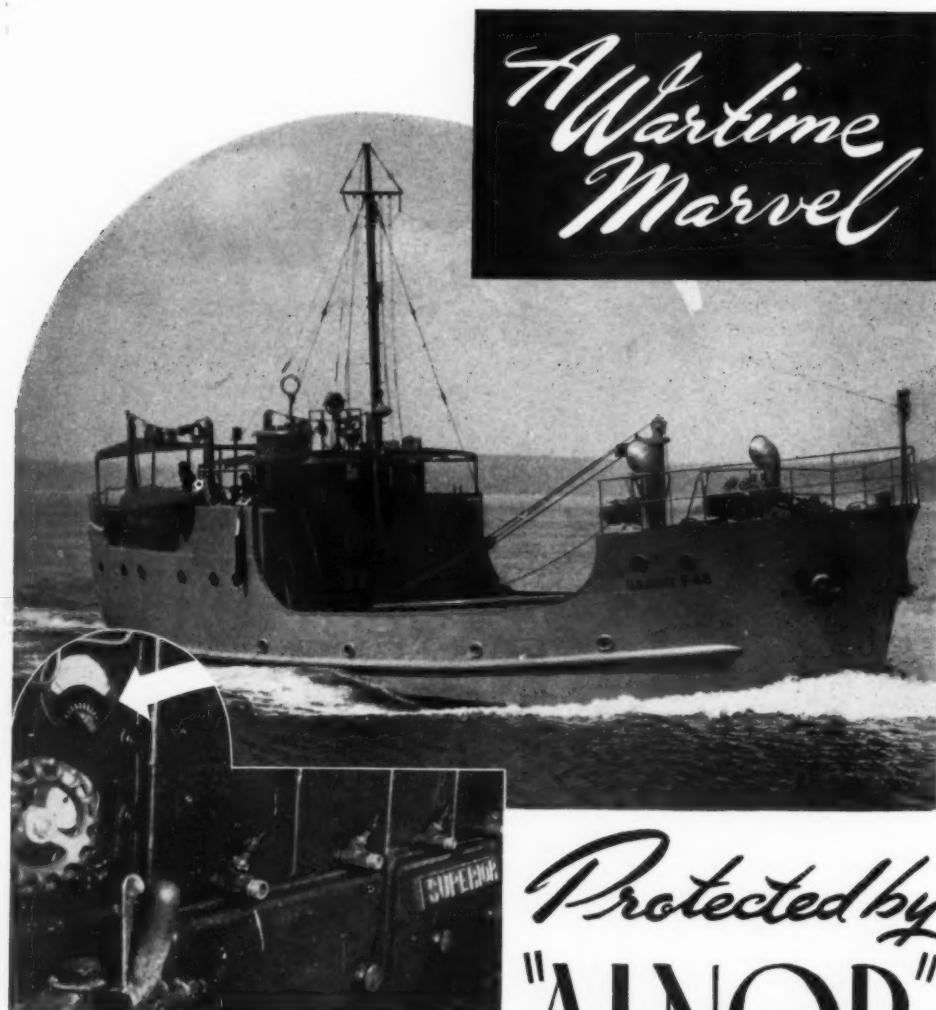
HEMPHILL INSTITUTE OF TECHNOLOGY

NEW YORK
3128 Queens Blvd.
Long Island City

Operating the Hemphill Diesel Schools at
CHICAGO
515 So. Western Ave.
*AMERICA'S ORIGINAL EXCLUSIVE DIESEL TRAINING INSTITUTION

LOS ANGELES
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421 Monroe Ave.



Protected by
"ALNOR"

These new 99 ft. Army freighters of 100 ton cargo capacity are marvels of perfection in design and construction. They are powered with modern Diesels — the F-48, illustrated here having a Superior 8 cylinder main engine—and every known modern operating and navigating accessory and protective device. Prominent in the long list of apparatus selected to render these vessels fit for almost any job are many names long identified with the Diesel Industry — including "Alnor" pyrometers.

Specify and Buy "Alnor"

Illinois Testing Laboratories Inc.

423 NORTH LaSALLE STREET, CHICAGO, ILLINOIS

MANUFACTURERS OF "ALNOR" AND PRICE INSTRUMENTS • PRODUCTS OF 43 YEARS' EXPERIENCE

Gilmore Epic Leads to Song for Sub Crews

NAVY'S Submarine Men Now To Have Own Fighting Song as written by Sailor-Songwriters.

The brave lads who man the submarines and carry the war to the very shores of Japan will soon be singing their own, official fighting song. Last of the services to get a song, the submariners now have "Take 'Er Down," a rousing melody with a two-fisted lyric recently written by Vic Mizzy and Irving Taylor, youthful veterans of Tin Pan Alley who are now serving in the Navy at the Tompkinsville, Staten Island, Base.

An America well aware of the Army Air Corps Song, Anchors Aweigh, Caissons Go Rolling Along, and others, first heard "Take 'Er Down," the night of October 26 when Raymond Paige and his "Young Americans" orchestra gave the song its world premiere in the NBC "Salute To Youth" program.

The new song, inspired by the heroism of the late Commander Howard W. Gilmore, who sacrificed his own life to save his submarine and crew in a battle with a Jap gunboat, was written at the suggestion of George Codrington, vice-president of General Motors and general manager of the Cleveland Diesel Engine Division of GM. In frequent contact with submarine officers, Mr. Codrington learned that the Submarine Force had no song of its own. He communicated with Mizzy and Taylor, agreed to underwrite printing costs, and now the song has been published by Santly-Joy.

All royalties will go into the Submarine Force Emergency Welfare Fund, and Mr. Codrington will turn over the copyright to the Navy as soon as the legal details are completed.



Vic Mizzy, left, composer, and Irving Taylor, lyricist, of "Take 'Er Down."

Vic Mizzy, who is 27, is the composer, and Irving Taylor, 29, the lyricist. They have been

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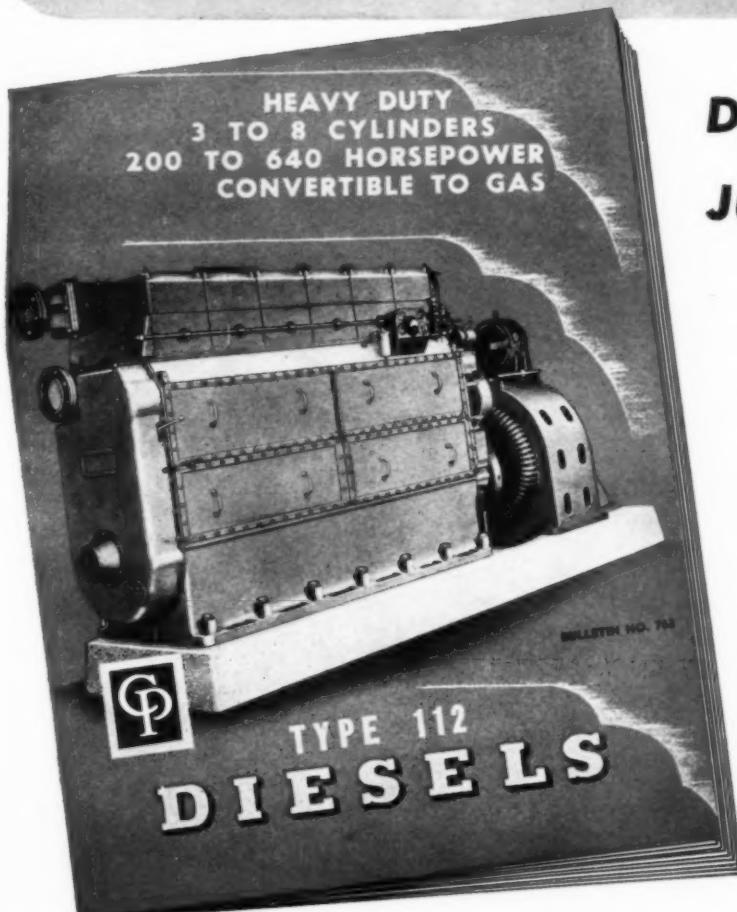
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TYPE 112

A Worthy Addition

TO CP DIESEL ENGINE LINE



Descriptive Bulletin

Just Off the Press

Model CP-112 Diesel is a heavy duty, medium speed, continuous service engine . . . 3 to 8 cylinders, 200 to 640 H.P., four-cycle, single acting, direct injection, totally enclosed. It is easily convertible to gas, and has been proved by two years test at the factory and in the field. A few of its salient features are: oil cooled pistons, 100% force feed lubrication, full floating piston pins, shell type bearings, accessible camshaft, pilot air starting, individual cylinder heads and fuel pumps, removable side covers, extreme rigidity of frame and base.

The advantages of CP design and construction are fully described in Bulletin No. 763. Write for a copy.

★★★★★★★
PNEUMATIC TOOLS
ELECTRIC TOOLS
(Hickey...Universal)
ROCK DRILLS

CHICAGO PNEUMATIC
TOOL COMPANY
General Offices: 8 East 44th Street, New York 17, N.Y.

★★★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

Demco

"PF" FUEL INJECTION PUMPS

- ★ Provide greater than average capacity
- ★ Yet — are interchangeable with other makes

Demco "PF" Fuel Injection Pumps are of the port controlled type—the quantity of fuel injected per stroke being governed by a metering helix on the plunger. By the use of a larger than average plunger diameter, Demco provides increased capacity. Long, trouble-free service is assured by the latest finishing methods employed on the rubbing surfaces. These flange mounted pumps conform to the most modern engineering practices and have been proved equal to the most exacting requirements.

AVAILABLE for prompt DELIVERY

Look to Demco for progressive fuel injection equipment.

DEMCO

DIESEL ENGINEERING & MANUFACTURING CORP.
200-214 NORTH LAFLIN STREET • CHICAGO, ILLINOIS



songwriters since their undergraduate days at New York University. Among their successes have been "There's A Far Away Look In Your Eye," "Three Little Sisters," and "Take It Easy."

Assigned to the Welfare and Recreation Department at their naval base, Seamen First Class Mizzy and Taylor stage entertainments and help keep the sailors in good spirits, "but we get our share of swabbing the decks, too," said Taylor; "as a matter of fact, we get lots of song ideas while pushing a broom."

With the title of the song repeated a number of times in the chorus, the lyric also declares: "Underneath the foam is home to submarines, "We can sweep the ocean clean if we keep trying, "When we take her home our broom will be a-flying."

The song is assured of the cooperation required for hit-dom these days, with several radio shows and popular night club orchestras already agreeing to feature the number, including Fred Waring, Calvacade of America, and others.

New Dock Expands H. O. Penn Machinery Facilities

IN order to keep abreast of present day demands for rebuilding and servicing of construction machinery, the H. O. Penn Machinery Co. has now added East River docking facilities at the Port Morris Terminal. The rebuilding of the dock just completed by A. M. Hazell brings to the H. O. Penn Realty Terminal ideal water delivery as well as double track railroad siding on the New York Central, all within crane's reach of the dock itself.



View showing large crane being handled by lighter at the H. O. Penn Machinery Company's new dock at Port Morris Terminal, East River, New York City.

As the H. O. Penn Machinery Co. is a large distributor of "Caterpillar" products including Marine Engines, it will now be convenient to service the many Diesel craft right alongside of the dock.

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Silenced...the sparks in Sparks' Ears

Yes...sparks had to be banished from Sparks' ears, for today radio communication is by voice. Voice communication from crew member to crew member. From pilot to pilot. From squadron leader to squadron leader. From Air General to every one of 9,000 airmen aloft in a 1,000 plane formation.

- Spark signals from the high tension ignition systems of aircraft would completely blot out radio voices. The ignition cables must be completely shielded—electrically and mechanically. Titeflex flexible metallic tubing is doing that job.
- But, what has this to do with *your* problem?
- *You may be responsible* for a vastly different product. But consider this Titeflex aircraft application as a performance test of flexible metal tubing...think of it in terms of your own flexible connection problems.

• Titeflex in aircraft performs on the front of the engine directly in a wind stream of over 300 miles per hour. It vibrates in mid-air under the full military power of a 2000 hp engine running at top speed. Rain lashes it in torrents—at tornado force.

- Yet, Titeflex remains *tight* enough to shield an electrical current of 10,000 volts. And all this at sub-stratosphere temperatures of 50° below, outside the tubing. And 300° above, at the spark plug end.
- Could any use-test be more convincing—whether your problem be the conveyance of oil, gasoline, acid, gas, water, steam, or electricity?
- Ask our application engineers to tell you more about Titeflex not only for wartime applications but also for postwar use.

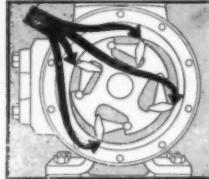
TITEFLEX METAL HOSE COMPANY
524 Frelinghuysen Ave., Newark, N.J.



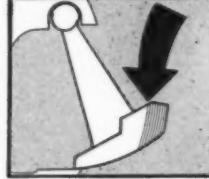
BLACKMER

• ROTARY •
PUMPS
are dependable
EVEN WHEN OLD
*that's because they are
SELF-ADJUSTING
FOR WEAR!*

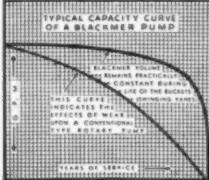
Like this—All of the wear is confined to the tips of the buckets, which automatically swing out farther, and take up the wear.



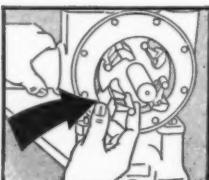
This much of a bucket can wear away without causing appreciable drop in capacity. On many jobs this means 10 year's service.



As the Curve shows, the capacity remains normal, no drop due to internal wear, until the buckets (swinging vanes) are entirely worn out.



At last when the buckets do wear out—they are replaced in 20 minutes and the pump restored to normal capacity.



POWER PUMPS

5 to 750 GPM. Pressures to 300 psi.

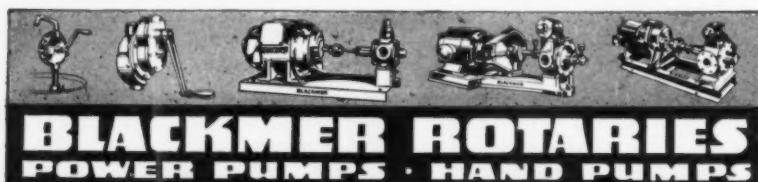
HAND PUMPS

7 to 25 GPM. 54 Models

For handling liquids varying from naphtha to asphalt, temperatures to 600°F.

Ask for Bulletin No. 304. It shows how these units cut pumping costs.

Write Blackmer Pump Company, 19812 Century Avenue, Grand Rapids 9, Michigan



Briggs Clarifier Company Reorganizes Sales Department

THE Briggs Clarifier Company has reorganized its sales force into two divisions, one for automotive distribution and the other for industrial distribution.



Henry T. Moore

Mr. Henry T. Moore has been appointed General Sales Manager, and Mr. E. K. Burgess and Mr. J. H. Nash have been appointed Assistant Sales Managers for the Automotive Division and Industrial Division, respectively.



E. K. Burgess

Mr. Moore has been associated with industrial sales work for the past 20 years. He was Sales Manager of the Hydroil Division of the Gould

ADECO



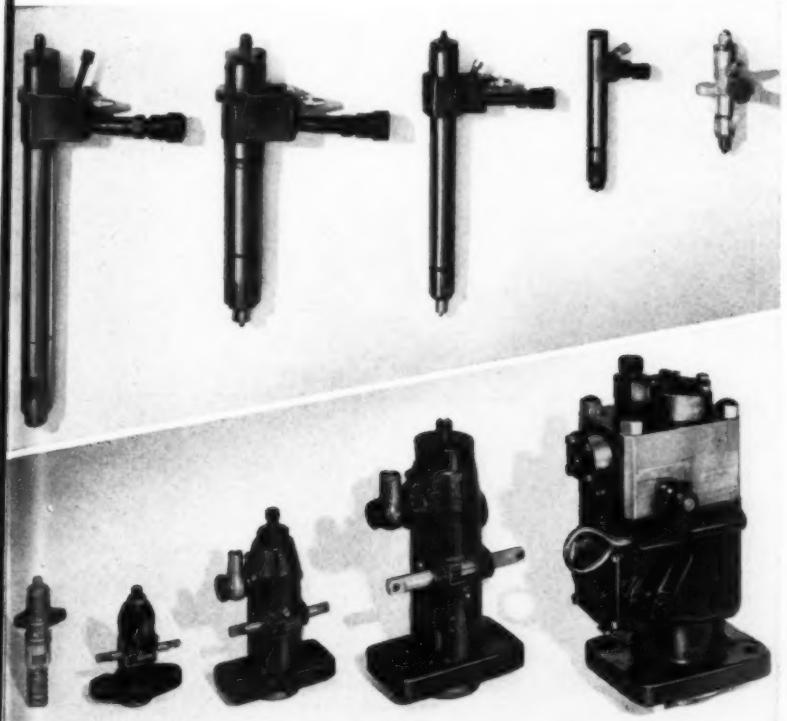
**DEPENDABLE
DIESEL FUEL
INJECTION EQUIPMENT**

Throughout the diesel industry, Adeco stands for the finest in fuel injection equipment. Years of experience in pioneering equipment for America's diesel needs have resulted in an outstanding line of fuel injection pumps, nozzles and nozzle holders. Today's performance of this dependable equipment merits your confidence for tomorrow's requirements.



ADECO NOZZLE TESTER For Economical Maintenance

America's most widely used Nozzle Tester enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests both large and small injectors. Avoids costly delays and possible damage to engine. Best for economical maintenance. Write for new illustrated bulletin.



Pump Company for 6 years and has been Eastern Zone Manager for Briggs for the past 3 years.



J. H. Nash

Mr. Burgess and Mr. Nash both have a background of successful sales experience in their respective fields.

Production Star to Weatherhead Co.

FOR continuing to achieve conspicuous production, the Weatherhead Company, Cleveland, Ohio, was awarded, on November 15th, the Star for such achievement to add to its Army-Navy "E" Flag.

Assuring that there will be no relaxation of this production drive among Weatherhead workers, the firm's dynamic president, A. J. Weatherhead, Jr. said, "The winning of this coveted distinction does not mean that we are going to rest on our laurels . . . rather, I am confident it will make every last man of us in this organization strive to not only hold to our present production pace, but to surpass it with even higher quotas. We all know that in the future we will have to produce under even more trying conditions of labor and material shortages, but produce we must, because through increased production this war will be shortened to a minimum."

Weatherhead's Army-Navy Star came just six months after the War Department awarded the firm the "E" Pennant in a ceremony at Cleveland attended by the 4,000 workers of the Cleveland plant. The Weatherhead Company is manufacturer of fittings and flexible hose assemblies. Its products are used in aircraft, military vehicles, boats and general industrial machinery.

AIRCRAFT & DIESEL EQUIPMENT CORPORATION

4401 North Ravenswood Avenue

Chicago, Illinois

A Symbol of Precision and Dependability



DIESEL FUEL INJECTION EQUIPMENT

Ex-Cell-O Diesel Fuel Injection Equipment has a background of a quarter century of precision production, including more than ten years of actual Diesel experience. In addition to recognized precision in manufacture, Ex-Cell-O Diesel Equipment has proven its soundness of principle and its ability to deliver dependable service under the most exacting conditions, both in civilian and military applications.

Ex-Cell-O Fuel Injection Pumps are available to Diesel engine builders in two basic types: Type KD (illustrated), for constant speed application, or variable speed applications where automatic timing advance is not required; Type KB, for use on Diesel engines requiring speed responsive timing advance and torque control throughout the operating range.

The Ex-Cell-O Nozzle also is specifically designed for efficiency and dependability and to provide long, trouble-free service.

For complete information, engine builders should address . . .

Diesel Division
EX-CELL-O CORPORATION • DETROIT 6, MICH.



Bacharach Issues New Bulletin on Maintaining Diesel Dependability

THE new bulletin on "Maintaining Diesel Dependability," just issued by Bacharach Industrial Instrument Company is a pictorial presentation of the many uses of the *Premax* Indicator in checking Diesel engine performance. Following a short introduction the pages of this interesting and instructive bulletin are filled with photographs of actual, on-the-job tests, using the *Premax* Indicator on all types of Diesels, with brief caption material explaining the various uses of this instrument. The Bacharach Industrial Instrument Company, 7000 Bennett St., Pittsburgh, Pa., will mail a copy of Bulletin 286 upon written request.

Ross Heater Opens San Francisco Office

A SAN FRANCISCO factory branch office has been opened by Ross Heater & Mfg. Co., Inc., manufacturer of all types of tubular heat exchangers, oil and water coolers, heaters, condensers, steam jet air ejectors, tube expanders and similar equipment.

Manager of the office, located at Central Tower, 703 Market St., is Richard N. Mathews, who will devote his time exclusively to the sales engineering of Ross equipment.



Richard N. Mathews, Manager Ross Heater and Mfg. Co.'s. new San Francisco office.

Transferred to the Pacific Coast from the company's Chicago office, Mr. Mathews has been with Ross for ten years, except for a recent period with the War Production Board.

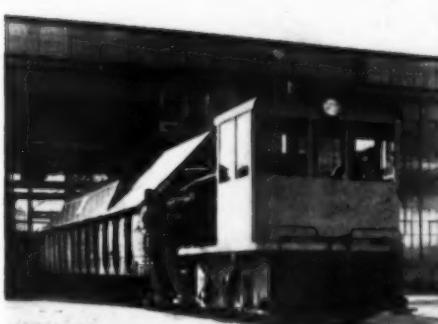
In addition to the San Francisco office, Ross equipment is handled on the Pacific Coast by R. D. Morse, Seattle, Wash., and W. S. Turner and Co., Portland, Ore.

dive 25-Tonner

GENERAL ELECTRIC 25-ton Diesel-electric switching locomotive which in its first two years of service operated approximately 14,000 hours still runs smoothly and continues to handle all the work at the Minneapolis plant of the Northern Pump Company. In the pages of bulletin bought in January, 1941, before the plant's expansion, the locomotive has required but one replacement part to date—a fuel pump. On call 24 hours a day, the Diesel-electric actually oper-

ates from 12 to 20 hours, averaging about 15 hours daily. Fuel oil consumption runs about 12 gallons a day during warm weather and slightly more during the winter. Refueling is required approximately every five days.

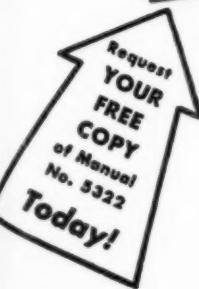
For inspection and maintenance work, the locomotive is run into one end of a building and routine servicing is taken care of during lunch periods or lulls in work. The 25-tonner handles all incoming and outgoing cars as well as all the switching inside the plant.



This Diesel-electric operates in and around new buildings, consequently its cleanliness is greatly appreciated.



UP-TO-THE-MINUTE 24-PAGE MANUAL ON COOLERS



LUBRICATING OIL
Engines
Gears
Turbines
Machine Tools
CUTTING OIL
QUENCHING OIL

TRANSFORMER OIL
HYDRAULIC PRESSES
ENGINE JACKET WATER
and wherever oil, water or
other liquids are circulated
for heat removal

You'll keep this informative manual on your desk for frequent reference to its practical, helpful data and illustrations in your WAR PRODUCTION and POST WAR PLANS.

CONTENTS INCLUDE: Special assemblies for individual conditions; shortcuts to cleaning and inspection; useful performance data, formulae, curves; maintenance of continuous performance; avoiding stagnant areas; special baffle arrangements; flexible mounting, vent and drain provisions; diversified nozzle arrangements; proper selection of materials and many other vital subjects for constant reference.

ROSS HEATER & MFG. CO., Inc.

Division of AMERICAN Radiator and "Standard" Sanitary Corporation

GENERAL OFFICES & PLANT

1425 WEST AVENUE

BUFFALO, 13, N. Y.



Northern Pump has enlarged its plant considerably since this 25-ton G-E Diesel-electric locomotive went into service, yet it continues to do all the switching.

During warm weather, the locomotive handles 10 or 12 cars at once, but during extremely cold weather when the friction is high, the drags are limited to three or four cars.

To further increase the locomotive's usefulness, the company plans to put a special low coupling on it so that it can handle small plant cars as well as standard railroad equipment.

The Diesel engine is a Cummins HBI-600 developing 150 hp. at 1800 rpm.

Mack Wins National Security Award

PRESENTATION of the National Security Award to Mack Manufacturing Corp. has been announced by the United States Office of Civilian Defense from Washington. Mack is one of five recent recipients of the award.

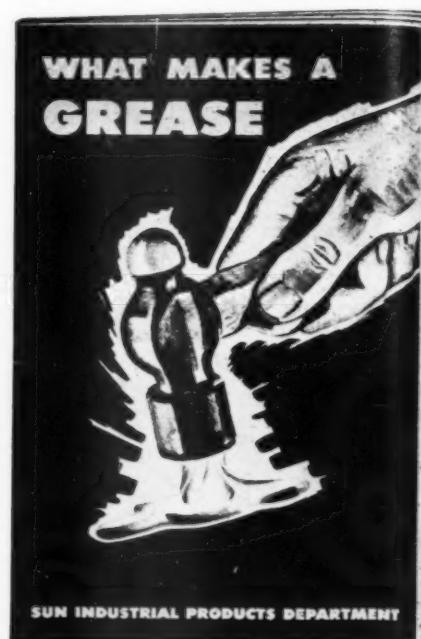
The National Security Award is granted by OCD to plants and facilities which have achieved outstanding success in programs for the protection of employees, plants, and production or service operations against fire, explosion, air raid, accident and other emergencies.

Winslow Engineering Issues New Filter Bulletin

A NEW booklet on use of Winslow Oil Conditioners and Oil Filters in Industrial applications has just been published by the Winslow Engineering Company, and is offered free to those using or contemplating the use of filtration equipment for coolant, cutting, hydraulic, transformer and Diesel fuel oils. The booklet is illustrated and includes diagrams of typical

installations. The contents include a general discussion of what happens to oils in industrial uses, special methods of construction of Winslow equipment, application of filters or conditioners to machine tool operation, hydraulic equipment, heat exchangers and transformers, general lubrication application, Diesel engines and internal combustion engines of all types. Write Winslow Engineering Company, Oakland, California, for your copy of this new bulletin.

The "What-Where-When-How-Why" of Industrial Greases



NO single problem which industry encounters is so universal and so fundamentally important as the "grease problem." Failure to keep up with new lubrication developments and methods, and the resulting failure to apply the right grease, in the right place, at the right time and in the right way, cause tremendous losses to industry every year . . . in time, money, materials, motive power and man power.

Such avoidable losses, of major proportions even in pre-war industry, have been multiplied many times under the staggering pressure of war production. Consequently, lubrication is rightfully receiving far greater attention than ever before by industrial engineers and production men. As a result, great strides are being made in many plants toward its solution.

As a part of the Sun Oil Company's campaign to improve lubrication methods and practice, the accumulative results of this long experience have been briefly summed up in a highly useful booklet, just off the press, entitled "WHAT MAKES A GREASE."

This booklet briefly discusses the standards by which a good grease should be judged. It points out the various factors which should influence the selection of the proper grease for a specific job. It describes the outstanding characteristics of the various Sun greases that have been developed for different uses . . . including Adhesive Pressure Grease, Gun Grease, Pressure System Grease, Roller Bearing Grease and Mine Lubricants. It cites specific applications of

FIRE-SAFE
POWER IN THE AIR!

- No Fire Hazard
- Lower Fuel Consumption
- Increased Cruising Range
- Greater Stamina
- Dependable Operation
- Instant Response to the Throttle
- No Ignition System
- Lower Cost of Fuel
- Constant Torque at all Speeds
- No Radio Interference

AMERICA'S ONLY RADIAL
AIR-COOLED
DIESEL ENGINE

ESTABLISHED 1919

GUIBERSON

THE GUIBERSON CORPORATION
GUIBERSON DIESEL ENGINE COMPANY
DALLAS, TEXAS

these greases and results obtained. It explains the service offered through Sun oil engineers in the study and solution of the many and varied "grease problems" encountered in every type of plant.

This authoritative little book offers valuable information for any industrial engineer or production man interested in lubrication. A copy may be obtained, without charge or obligation, by writing to the Sun Oil Company, Dept. 44, 1608 Walnut Street, Philadelphia 3, Pa.

Third West Coast Office Added by Cooper-Bessemer

THE opening of another Pacific Coast factory branch office has just been announced by officials of The Cooper-Bessemer Corporation. The new office, located at 401 Rust Building, San Francisco, California, is the third of three branches serving the west coast area. The other two offices have long been established at Los Angeles, California, and Seattle, Washington.

According to company spokesmen, the new San Francisco branch, under the local supervision of service representative John G. McKissick, will facilitate the installation and maintenance of Cooper-Bessemer Diesel engines in Army and Navy vessels constructed in the northern California territory. The corporation has recently added a gold star to its Maritime Pennant for continued outstanding production.

Chicago Metal Hose Issues a New Engineering Bulletin

A NEW illustrated engineering manual (SS-44) on Rex-Flex Stainless Steel Flexible Tubing and Bellows has just been issued by Chicago Metal Hose Corporation of Maywood, Illinois. This manual contains much engineering data and specifications not heretofore published. Characteristics of the product are shown in detail, with tables of sizes, weights, wall thicknesses of the various wall forms, together with pressure data, minimum bending radii and a wealth of other detail useful to the engineer. Complete data on fittings is also given, with diagrams and instructions for attaching fittings, and recommended design procedure for various types of applications. One feature of special interest is the double page spread giving, in chart form, line-loss data on Rex-Flex Tubing and Elbows. There are many detailed photographs and illustrations of new interest to design, production and maintenance engineers in the 36 pages of this new two-color book. Published by Chicago Metal Hose Corporation, Maywood, Illinois.

Blackmer Pump Opens New Philadelphia Office

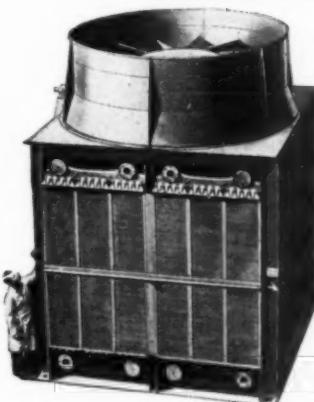
AS a part of their program of expanding sales and service facilities, J. B. Trotman, General Sales Manager of the Blackmer Pump Company, Grand Rapids 9, Michigan, has announced the opening of the company's new office in the Commercial Trust Building, 15th and Market Streets, Philadelphia, Pennsylvania.

The new Blackmer office will be in charge of

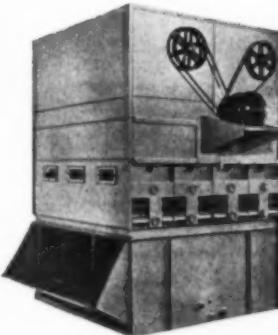
Mr. B. Dunkley, an engineer of long experience in the pump work. For many years, Mr. Dunkley has specialized in industrial pumping problems and is well known throughout the eastern Pennsylvania, New Jersey and Delaware territory for his work in that field.

The area served by the new Blackmer Philadelphia Office will include eastern Pennsylvania, Southern New Jersey and a part of the State of Delaware.

Young Units for ENGINE COMPRESSOR Installations



Young Quad Cooling and Condensing Towers maintain the jacket water and lube oil of large engines and compressors at suitable operating temperatures . . . radiator type units offering the many advantages of closed system cooling. Also for the cooling of compressed gases and vapor condensing.



Young Evaporative Coolers and Condensers may be used as complete units or in conjunction with Young Quads, to obtain temperatures below the ambient dry bulb. Operating costs and make-up water requirements are held at a minimum with these highly efficient units.



A complete line of heating, cooling and air conditioning products for administration, factory and equipment buildings is also designed and manufactured by Young. Unit heaters (illustrated) are especially suitable for the rapid heating of work areas and drafty entrances. Representatives in most principal cities.

LARGEST of the Young radiator type units, Quad Towers will handle the heat rejection load of entire compressor systems. A single unit can be so constructed that it will accommodate the jacket water and lube oil of both the driving internal combustion engine and the driven compressor—and cool gases after both intermediate and final compression stages. For larger installations, each of the liquids and gases will require separate units or batteries of units. When temperatures below the ambient dry bulb must be obtained, Young Evaporative Coolers can be employed as complete units or be used in combination with Quad Atmospheric Cooling Towers. Both of these Young units embody special patented features . . . the result of continuous research and field observation. Write for complete engineering data on their application in your compressor systems.

YOUNG RADIATOR CO., Dept. 233-M., Racine, Wis., U.S.A.

Distributors:

Wrightson and Campion, New York, N. Y.

The Happy Co., Tulsa, Okla.

A. R. Flournoy, Bell, Calif.

BUY BONDS
PRODUCE MORE
SALVAGE SCRAP
WIN THE WAR

YOUNG

HEAT TRANSFER PRODUCTS

Oil Coolers—Gas, Gasoline, Diesel Engine Cooling Radiators—
Intercoolers—Heat Exchangers—Engine Jacket Water Coolers—
Unit Heaters—Convector—Condensers—Evaporators—Air Conditioning Units—Heating Coils—Cooling Coils—and a complete line of Heat Transfer Equipment for aircraft.



Volume Eight of the DIESEL ENGINE CATALOG is now available. Completely revised, this book contains the description and detailed specifications of One Hundred and Sixty-two engines. Nothing like it published. The most useful Diesel book available, containing a complete cross section of this rapidly expanding industry, insofar as the engines and accessories available are concerned. An indispensable book for all interested in Diesel engines.

ORDER YOUR COPY OF VOLUME EIGHT • NOW!

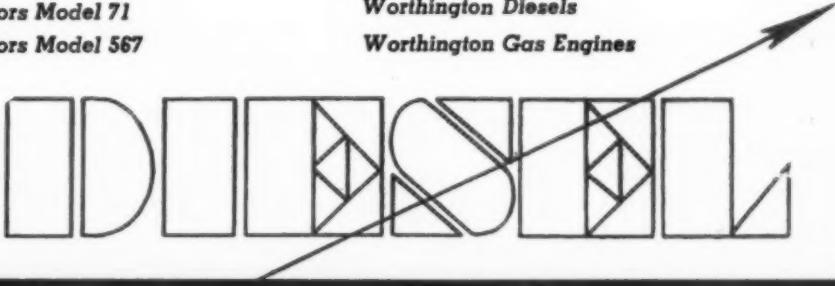
162 engines described and illustrated



NOW READY
TO MAIL
NEW - BIGGER - BETTER

DIESEL ENGINES DESCRIBED

- Alco Four Cycle Stationary
- Alco Universal Type
- Alco-Sulzer "T" and "TM"
- Atlas Imperial
- Atlas-Lanova
- Buckeye Diesels
- Buda-Lanova Diesels
- Busch-Sulzer Bros. 2-cycle
- Busch-Sulzer Bros. 4-cycle
- Caterpillar Industrial Engines
- Caterpillar Marine Engines
- Chicago Pneumatic Model 8-CP, and 9-CP
- Chicago Pneumatic Type 16-CP
- Chicago Pneumatic Type RHB-50
- Clark Bros. Diesels
- Consolidated Diesel Electric Power Units
- Cooper-Bessemer Type JS
- Cooper-Bessemer Type EN & GN
- Cooper-Bessemer Type LS Marine
- Cummins Diesels
- De La Vergne Series 10
- De La Vergne Model VG
- De La Vergne Model VM
- De La Vergne Gas Engines
- De La Vergne Model VO
- Dodge-Lanova Diesels
- Enterprise Diesels
- Fairbanks-Morse 33 and 37
- Fairbanks-Morse 36
- Fairbanks-Morse 42
- Fairbanks-Morse 32 and 35
- Fairbanks-Morse Model 38
- Fairbanks-Morse Model 46
- Fulton Diesels
- General Motors Model 71
- General Motors Model 567
- Gray Marine Diesels
- Guiberson Radial Diesels
- Hamilton Engines
- Hercules Diesels
- Hill Diesels
- Ingersoll Rand Type "S"
- International Harvester
- Kahlenberg Engines
- Kermath 4-cycle
- Lathrop Types D50 and D80
- Lister-Blackstone Diesels
- Lorimer Diesels
- Mack-Lanova Diesels
- Murphy Diesels
- Nordberg 4-cycle Diesels
- Nordberg 2-cycle Diesels
- Nordberg Gas-Diesels
- Palmer Bros. Diesels
- Rathbun-Jones Diesels
- Rathbun-Jones Gas Engines
- John Reiner Marine Units
- Sheppard Diesels
- Superior Model "A"
- Superior Model "D"
- Superior Type M
- Superior Type S
- Union Diesels
- U. S. Diesel Plants
- Venn-Severin Models HC and M
- Washington Iron Works Diesels
- Waukesha-Hesselman Type
- Witte Types
- Wolverine Diesels
- Worthington Diesels
- Worthington Gas Engines



DIESEL ENGINES, INC.—Two West Forty-Fifth Street—New York 19, N.Y.

Send my order for a copy of the New Diesel Engine Catalog, Volume Eight, Edited by Rex W. Wedman, for which I enclose \$5.00.

NAME: _____

ADDRESS: _____

Please print name and address

Sorry, we cannot imprint names on this year's edition of the Diesel Engine Catalog

American Locomotive Company Elects Robert McColl

ROBERT B. MCCOLL, Vice President, Manufacturing, American Locomotive Company was elected a director of the company at the regular meeting of the Board of Directors on Thursday, October 28, 1943.



Robert B. McColl

Mr. McColl was born in 1882 at Kilmarnock,

Scotland, where he attended the Kilmarnock Academy and the Science and Art College. After serving a special apprenticeship and working in various departments on the Glasgow & Southwestern he was employed by Robert Stephenson & Sons, locomotive builders, Darlington, England, as draftsman.

In 1905 he went to the Montreal Locomotive Works, Ltd., Montreal, Canada, and served in several departments until he became Assistant Superintendent, then Superintendent of Works and finally Works Manager. In 1917 he was appointed Manager of the Munitions Department of the Eddystone Munition Company, where he served until after the Armistice.

Returning to England he was appointed General Manager of the Armstrong Witworth Company. Mr. McColl is still a member of the Institute of Mechanical Engineers, London, England.

In January, 1922, he became attached to the New York Office of the American Locomotive Company. The following June he was appointed Assistant Manager of the Schenectady Plant, and in January, 1925, Manager of the Plant. In 1931, he was elected President and

Director of the McIntosh & Seymour Corporation, Auburn, N. Y., a Division of the American Locomotive Company, and when the McIntosh & Seymour Corporation was merged with the parent company, Mr. McColl was appointed Vice President of the American Locomotive Company, Diesel Engine Division. In 1936 he was elected President of the Alco Products, Inc., a Division of the American Locomotive Company, and later when Alco Products, Inc., was merged with the parent company he was appointed Vice President of the American Locomotive Company, Alco Products Division. On March 1, 1940 Mr. McColl was appointed Vice President, Manufacturing.

John Reiner & Co. Receives a Star For Its Army-Navy "E" Pennant

ON February 20, 1943, John Reiner & Company, Long Island City, N. Y., was awarded the Army-Navy "E" flag for excellence of performance in the production of Diesel Auxiliary Units and Generating Sets for use aboard many classes of ships and by the army in several phases of its work. Taking the award in stride, management and workers continued their efforts, striving to surpass previous records. On October 29, 1943, the first star was added to the flag in recognition of their continued good work.

CONTINUOUS, DEPENDABLE POWER for WAR INDUSTRY

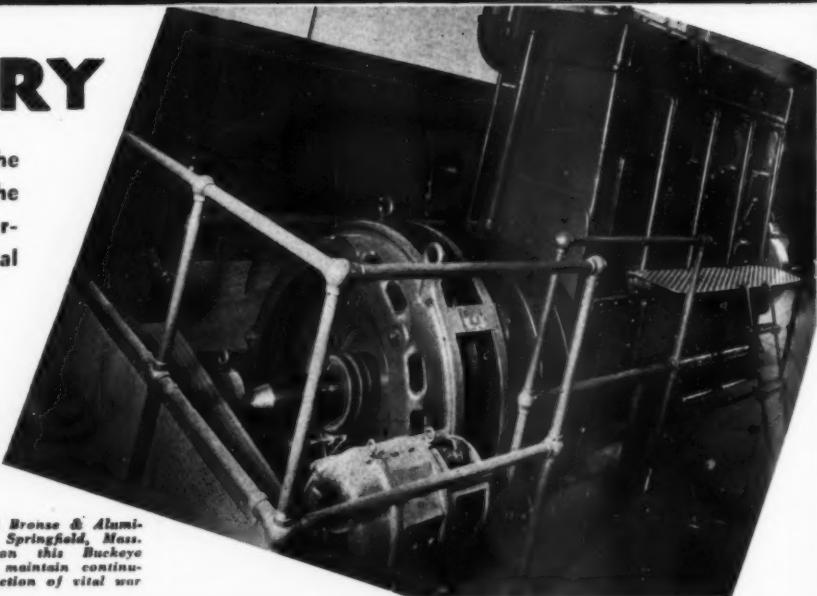
Yes, Buckeye Diesels are in the war and behind the war, turning out low-cost, dependable power for the urgent needs of our war effort. Buckeye Diesel performance, economy, and long life are the natural results of Buckeye's distinctive features—

- ★ Silent Watchman
- ★ Speed Watchman
- ★ Full Pressure Lubrication
- ★ Reversible Shell-Type Silver Alloy Bearings
- ★ Complete Engine Enclosure

Plus Buckeye Craftsmanship backed by 35 years' experience.

Engine Builders Since 1908

Springfield Bronze & Aluminum Co., Springfield, Mass., depends on this Buckeye Diesel to maintain continuous production of vital war material.



Be Profitwise and Dieselize with Buckeyes
THE BUCKEYE MACHINE COMPANY LIMA, OHIO

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29, 1943,
recognition

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Compressed Air and Gas Cooling Equipment

IMPROVED equipment for the cooling of compressed air results in drier air and prevents water damage to pneumatic equipment; for example: rapid wearing out of parts because of washing out of lubricants—freezing up of pneumatic tools halting production—damage to work by water in paint spray, rusting of metallic shot in blast cleaning equipment.



The new Niagara Aero After Cooler for compressed air uses the evaporative cooling principle to obtain the lower temperatures and a new design gives greatly increased capacity in compact apparatus. Air, drawn by a fan through a water spray across coils containing the compressed air is the cooling medium and temperatures within 10° of the wet bulb air temperature can be maintained. This permits lower temperatures by 10° to 25° than conventional coolers and produces compressed air that contains only one-half to three-fourths the amount of water formerly experienced with the best practice. The equipment is also applied to gases generated for industrial use. The manufacturer is the Niagara Blower Co., 6 E. 45th St., New York 17, N. Y.

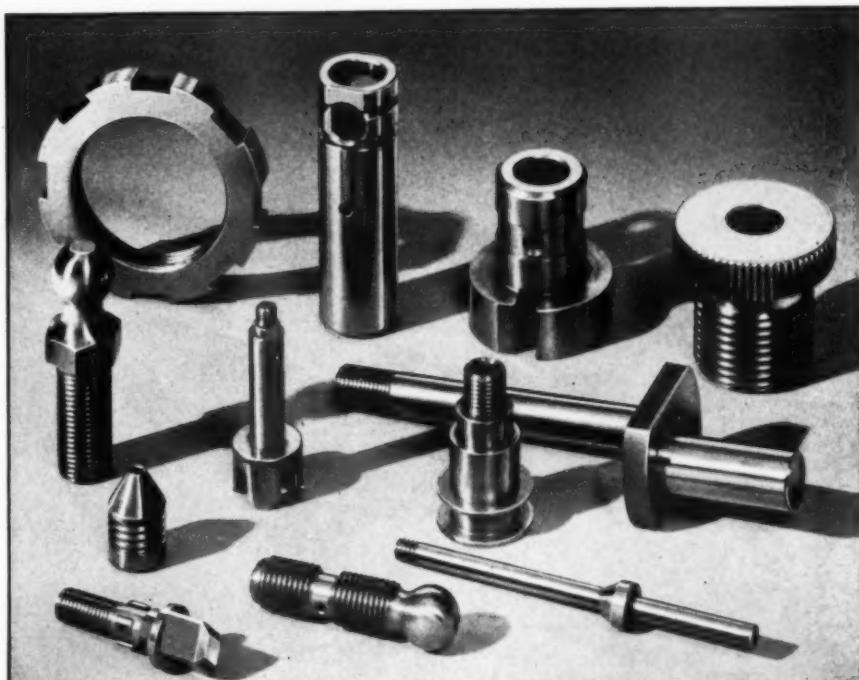
Mack Preparing Diesel Manuals for U. S. Army

A NEW series of technical manuals on the Mack 10-ton Diesel cargo carrier are now being prepared for the U. S. Army by Mack's Technical Service Division, according to C. F. Drumm, manager of general service engineering for Mack Manufacturing Corp.

Men compiling the book are actually assisting in the tearing down and rebuilding of the huge Diesel engine and transmission with the sole aid of Army tool kits. In this way the step by step procedures are being workchecked as they are written.

The other technical manuals compiled for the armed services by Mack have contained the necessary information in a single volume. The new presentation will cover service and maintenance step by step in three profusely

illustrated manuals. The first book will contain information for the driver and minor repair instructions. The second manual will concern itself with repairs on units and sub-assemblies, while the third book takes in major and production repairs. In this way the work of the various echelons is segregated.



"CHICAGO SCREW"

--a name to remember for Hardened and Ground Parts

We are specialists in the manufacture of all kinds of Milled from Bar and Cold Upset Products made to the most exacting mechanical specifications. Hardened and Ground Products are being turned out by the millions with secondary operations included—Milling, drilling, slotting and broaching. Internal, cylindrical and surface grinding. Thread Grinding, Thread Hobbing and Roll Thread-ing to Aircraft Quality Standards.



THE CHICAGO SCREW CO.

ESTABLISHED 1872

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**"THIS YEAR, LET'S PAY THE BONUS
IN WAR BONDS"**



... and drive even harder on the pay-roll savings plan!"

Make War Bonds the Christmas Order of the Day. Urge your workers to make their personal Christmas gifts in the form of War Bonds—and practice what you preach! Make this a 100% War Bond Christmas—to insure future Yuletides of peace and prosperity.

Make up your own posters to spread the "War Bonds for Christmas" story across your plant. Tell the story again and again on bulletin boards, in your plant magazine, and on pay envelope stuffers.

But don't forget your basic, all-important Pay-Roll Savings Plan. How's it going, these days? Perhaps it needs a bit of stoking-up right this very minute, to hold its full head of steam against the competitive demands of the holiday season.

Well, you're the man to stoke it! You can't expect it to keep running indefinitely on last summer's enthusiasm. See to it that your participation percentages, and your deduction percentages, both end up the year at new levels.

Every month, now your Pay-Roll Savings ought to run well ahead of the preceding month. For so many families that formerly depended on the earnings of a single worker, now enjoy the combined earnings of several. Such family incomes are doubled, trebled, even multiplied many times.

Now's the time to turn as much as possible of these increased earnings into War Bonds—War Bonds for Christmas . . . and War Bonds the whole year 'round!

GIVE THE PRESENT WITH A FUTURE—WAR BONDS!

This space contributed to Victory by

This advertisement prepared under the auspices of the United States Treasury Department and the War Advertising Council

**Pearson Named Sales Manager
Superior Engine Division
of National Supply**

THE National Supply Company has announced the appointment of R. M. Pearson as Manager of Sales, Superior Engine Division.



R. M. Pearson, recently appointed Sales Manager, Superior Engine Division, National Supply Company.

Mr. Pearson has been affiliated with the National Supply Company since 1936 in the capacity of sales representative serving the marine trade and the inland waterways. He has been actively engaged in the sale of Diesel engines for the past twenty years and served on the sales staffs of Fairbanks, Morse & Company; General Motors Corporation, and American Locomotive Company prior to his service with Superior.

Before entering the Diesel field, Mr. Pearson was prominent in engineering circles in the Pittsburgh area in a designing and executive capacity.

**Crocker Wheeler Appoints
Wallace K. Brown New York
District Sales Manager**

WALLACE K. BROWN, former vice-president in charge of Procurements for the Crocker-Wheeler Electric Manufacturing Company, has been made manager of the New York District sales of the Crocker-Wheeler Division of the Joshua Hendy Iron Works office there.

Mr. Brown first came with the Crocker-Wheeler Electric Mfg. Co. in 1908 as an apprentice engi-

neer, after completing his technical training at Clarkson College of Technology and the University of Illinois. Since that time he has been district manager in San Francisco and Newark and Eastern Sales Manager in New York. In addition to his company duties, Brown is serving on the subcommittee on Government Questionnaires, War Production Board. He is also acting in an advisory capacity with respect to Export and General Crocker-Wheeler Division sales matters.

**Weaver Heads New Marine
Department of Westinghouse**

TO best serve the expanding maritime field, the formation of a separate marine industry department by Westinghouse Electric and Manufacturing Company is announced by F. H. Stohr, Manager of Industry Departments.

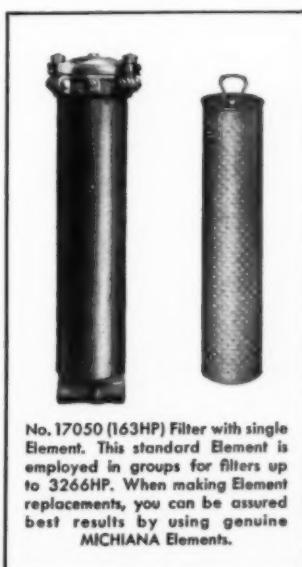
Mr. Charles H. Weaver is appointed manager of the newly formed Marine Department, and will direct all commercial activities. This re-

CONTINUE TO PROTECT YOUR ENGINES

When Servicing Your Filters Insist on Genuine MICHIANA Elements

With conserving of critical metals still important, it is your job to prolong the life of your engines. With man shortage still more acute, the need for insuring maximum dependable engine performance is more urgent than ever.

To be sure of dependable engine performance,—to reduce needless shutdowns and repairs,—always replace the filter elements of your MICHIANA Oil Filters with genuine MICHIANA Elements,—designed expressly for these filters. No other Elements have the high dirt-absorbing capacity provided by MICHIANA Wastex filtering material. MICHIANA PRODUCTS CORPORATION, Michigan City, Ind.

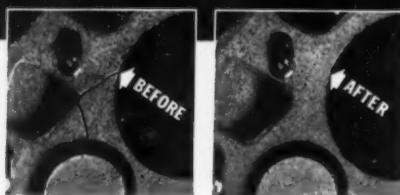


No. 17050 (163HP) Filter with single Element. This standard Element is employed in groups for filters up to 3266HP. When making Element replacements, you can be assured best results by using genuine MICHIANA Elements.



**DON'T TAKE CHANCES
THIS WINTER!**

**Repair those
CRACKED
MOTORS
by this modern,
guaranteed method**



**1 K & W COLD WELD
FOR MAJOR REPAIRS**

Repairs made by the K & W COLD WELDING METHOD are guaranteed for the life of the motor!

Heat and freeze cracks of every type and description repaired by this method have withstood severest tests in summer and sub-zero temperatures. It has restored to service, at tremendous savings to their owners, countless thousands of truck, bus and tractor motors, steam and marine engines, and even pumps and boilers!

K & W COLD WELDING service is available everywhere through local K & W licensed repair stations, and at our own Factory Service Stations. Ask your own jobber or write direct for details.

**2 K & W METALLIC SEAL
FOR MINOR REPAIRS**



K & W Metallic Seal is not just another "crack stuffer." It seals with metal, and is sold on a money-back guarantee. It will not flush out, or leave sediment to clog up the cooling system. One application through the radiator (without removing hose or thermostats), is sufficient in most cases to effect a lasting repair. Keep a supply on hand for the small jobs, and to take care of winter emergencies.

NOTE—Operators who maintain their own shops can obtain a license under K & W patents to use the K & W COLD WELDING METHOD. Mechanics of licensees are trained by K & W free of charge. Ask your jobber, or write direct for details.

**K&W KERKLING
& COMPANY
BLOOMINGTON, INDIANA**

West Coast Office and Repair Station
6516 Selma Avenue, Hollywood 28, Calif.

sponsibility includes the coordination of marketing of the diversified products of the company that are used for marine service.



G. H. Weaver, Manager of the newly formed Marine Department of Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.

Mr. Weaver, as former manager of the Marine Section of the Industrial Department is well known in the marine industry. He was born in Philadelphia and graduated from the University of Pennsylvania in 1936 with a degree of Bachelor of Science in Electrical Engineering. He joined Westinghouse as a member of its student course in 1936. Two years later he was placed in the sales department of the generator division, remaining there until 1940 when he was transferred to the Marine Section of the Industrial Department.

Second Generation of Mulfords Heads Gray Marine

JOHN W. MULFORD, who succeeds his father, the late O. J. Mulford, as president of the Gray Marine Motor Company, continues the direction of the company under a man who has all his life been closely associated with the boating industry.

At the age of 41, Mr. Mulford has established himself as one of Detroit's business leaders, and among his other activities he is president of the Detroit and Georgian Bay Navigation Company. Like his late father, Mr. Mulford is an ardent boating enthusiast, with an experienced eye to design and the industry's development.

The Gray Marine Motor Company, founded by O. J. Mulford in 1906, was a pioneer in the development of the internal combustion engine for marine use, and it has continuously been

**Dirty fuel
DESTROYS
diesel engine
efficiency**

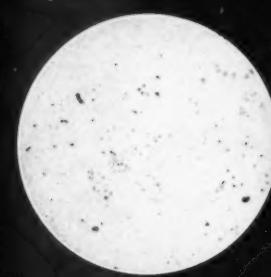


Photo-micro shows 45 times enlargement of the abrasives in one cc. of refined fuel oil. Sample taken after fuel had passed engine filter ready for injection. Chemical analysis showed—Moisture .35%, sediment .035%, Tarry matter .0475%.

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Photo-micro shows 45 times enlargement of contamination in one cc. of the same refined fuel after passing one time, full flow, through a Honan-Crane Fuel Oil Purifier. Chemical analysis showed—Moisture .005%, sediment .0035%, Tarry matter .003%.



The removal of contamination from Diesel fuel oils will . . .

1. Protect fuel pumps.
2. Reduce pitting and wear on injector equipment.
3. Prevent ring sticking and reduce upper cylinder wear.
4. Reduce contamination in lubricating oil.
5. Protect valves and ports.

For complete information
write for Bulletin No. 65.

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John W. Mulford

a leader in the marine field. During World War II the company has devoted all of its greatly expanded resources to the production of marine engines, both gasoline and Diesel, for the U. S. Government and Allied Nations. Thousands of men in the U. S. Armed Forces have become familiar with the Gray Marine Diesels as used in the Landing Boats and Invasion Barges of the U. S. Navy, and with special models of Gray gasoline engines delivered in large quantities for lifeboats, towing boats and other wartime applications.

Nordberg Wins Third Star For Navy "E" Pennant

FOR sustained quality and quantity production for the Navy in three successive six-month periods, Nordberg Manufacturing Co. has been awarded a third star for its Navy "E" pennant. Additional recognition of Nordberg excellence in war production is seen in the award of a second star for its Maritime "M" pennant which it originally won in May of this year.

Mechanics Attend Mack Diesel School

A SPECIAL service, maintenance and repair school on Mack Diesel engines is now being conducted at the company's general service engineering laboratory, Long Island City, N. Y. for Mack mechanics within the metropolitan area, according to C. F. Drumm, manager of general service engineering for Mack Manufacturing Corp.

Realizing the necessity of compressing the course into as short a span as possible so that urgently needed mechanics can get back to their shops, the school is focusing its entire attention on just

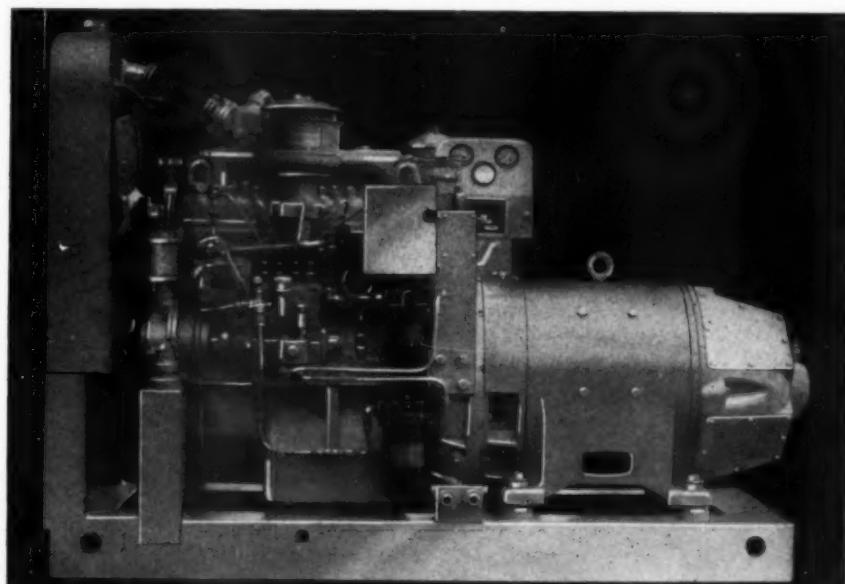
PERFORMANCE OF THIS AIR COMPRESSOR IS Global-Tested

ABOARD tank-landing craft...deep in the engine rooms of merchant ships...high in the air on army transport planes...on battle-scarred airfields and throughout wartime industry, Quincy Compressors are turning out an efficient and dependable supply of compressed air for our fighting forces...Their new, global-tested performance is indeed a well-

earned role to follow the days when almost a hundred leading manufacturers equipped their products with Quincy Compressors for service all over the world...Quincy Compressors provide air for Diesel starting and other services requiring intermittent pressures up to 500 lbs. per sq. in. If you have compressed air problems, let us help you solve them!

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**Duplex Truck Co.
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FULFILLING THEIR
**TASK
ASSIGNMENT**

"R-C" BLOWERS
HELP MAINTAIN
DIESEL EFFICIENCY

Meeting the exceptional mechanical and performance standards demanded by the Navy is about the most conclusive stamp of excellence that can be placed upon a product. And when it comes to standing up to the toughest kind of service conditions, Roots-Connersville supercharging and scavenging blowers are teammates worthy of any Diesel.

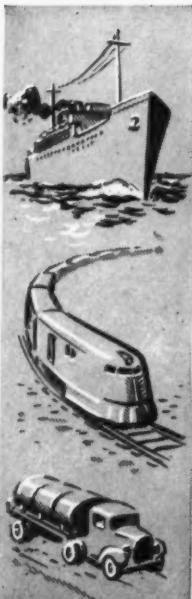
Illustration shows 8,000 CFM, 5.4 lbs. blower driven by direct connected Superior Diesel engine supplying scavenging air to main Diesel propulsion engine on escort ship. Independent Diesel engine or DC motor drive to blower is ideal for scavenging main ship engines under reversing operation and for delivering variable air quantities needed to produce exact engine performance under different speed conditions. Write for bulletin.

**ROOTS-CONNERSVILLE
BLOWER CORPORATION**
312 Midland Ave., Connersville, Ind.

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SINCE 1854

*Supercharging
and Scavenging*
BLOWERS

FORWARD TO BETTER DESIGN

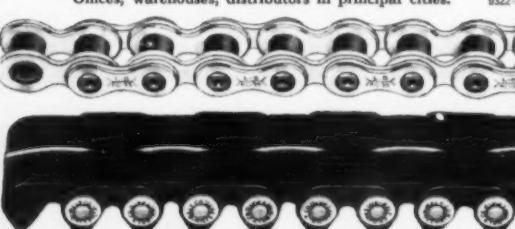


Link-Belt Silent and Roller Chain present numerous and varied possibilities for application to take-off, and accessory drives that greatly widen the horizon for Diesel designers.

A discussion of your present problems with Link-Belt engineers may disclose unsuspected opportunities to advance the development of the Diesel engine, and increase its efficiency, performance and long life. Builders and users are invited to consult Link-Belt for aid in operating, building or planning of this important power source.

LINK-BELT COMPANY

Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Toronto 8
Offices, warehouses, distributors in principal cities.



LINK-BELT Diesel
CHAIN DRIVES
SILENT AND ROLLER TYPES

those parts of the engine that are the basis of Diesel operation: fuel pump, nozzles, governor and ante-chambers.

Present plans call for three class sessions. However, this series can be expanded when needed. Mr. Drumm says. Instructor for the course is F. W. Fischer, Mack field engineer.

West Coast Diesel News By JIM MEDFORD

COOPER-BESSEMER Diesels rate a leading place for the sale of 120/1,000 hp. engines with G.E. generators and Birmingham gears plus Ward Leonard controls to Basalt Rock Co., San Francisco, for installation, four to a boat, for U. S. government.

TO power a Monighan (a walking dragline), Shepherd Diesel Marine report the sale of four Caterpillar marine Diesels with a total horsepower of 465 to Macco Contractors for use on Mississippi River project.

THE oil fields continue to go strong for Caterpillar Diesels: Bender Oil Co., have taken delivery in a Shepherd-constructed Gardner-Denver slush pump with 115 hp. engine on a portable unit, their second purchase.

EQUIPPED with Burgess snubbers and intake filters and Honan-Crane lube filters, two Fairbanks-Morse Diesels of 150 hp. at 300 rpm. direct connected to F-M 97 kw. generators have been delivered to the U. S. Engineers.

DEMAND for increased agricultural products has increased Caterpillar Diesel irrigation installations: one 60 hp. unit to Travis Farms, Blythe; one 100 hp. unit to Fred Stanley, Lancaster, and Ed Claridge, Safford; and one 35 hp. unit to Frank Cox, Wyckenburg.

AT the Harold Hansen Boat yards, Seattle, Washington, Walter Hossfeld's 65-foot combination fisher has taken on new life with the recent installation of a 95 hp. Atlas Imperial Diesel.

GETTING ready for a busy fishing season, the Van Camp Sea Food Co., Terminal Island, California, has completed repowering two of its 35-footers with 312 cubic inch Caterpillar Diesels for *Jimmy James* and *Andy Zukor*.

ASSOCIATED Shipyards at Winslow, Washington, has taken delivery a 900 hp., direct reversible, 8-cylinder Cooper-Bessemer supercharged Diesel with hydraulic coupling for installation in a government vessel now under construction.

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MAGELLAN, one of the larger clippers fishing for tuna out of Southern California ports for the Franco-Italian Packers has had installed a 70 hp. Atlas Imperial Diesel with G.E. generator.

THE French Sardine Co., Terminal Island, California, has installed in its Sea Ranger a 312 cu. in. Caterpillar Diesel. Another of the same size went into the 80-foot Long Island.

LOUIS ALLIS' new 80-foot purse seiner to be constructed by Al Larson boat yards, Terminal Island, California, will get an Enterprise Diesel for main engine; a Caterpillar Diesel with 30 kw. generator as auxiliary.

AT Astoria, Oregon, Fisher Bros., Caterpillar Diesel distributors, have repowered the Howard Bronson dragger with a 135 hp. Diesel. This is one of the pioneer otter-trawl fishers.

EQUIPPED with hydraulic couplings and of all steel construction, a Cooper-Bessemer 11½ by 13½ and 900 hp. at 500 rpm. Diesel has been delivered to the General Drydock and Engineering Co., Alameda, California.

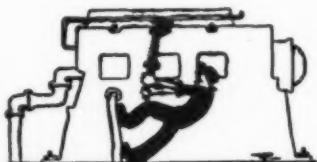
ANOTHER Enterprise Diesel, six cylinder, 400 hp. at 400 rpm. and direct reversible, went into the 80-foot Pan American by Martinolich yards, San Francisco, for John Spadaro.

AT the Higginbotham Bros. yards, Stockton, California, a new twin screw steel tug of 55 feet is powered with Caterpillar Diesels of 100 hp., fitted with Twin Disc gears.

THE 65-foot Harmony of the French Sardine Co., San Pedro, California, has been repowered with a four cylinder, 160 hp. at 400 rpm. Fairbanks-Morse Diesel. Direct reversing, it is equipped with F-M sailing clutch.

ANOTHER Washington Diesel of 240 hp. has been installed by W. R. Menchins yard at Coal Harbor, B. C., in the B. C. Packers, Ltd., 78-foot seiner Tahoe.

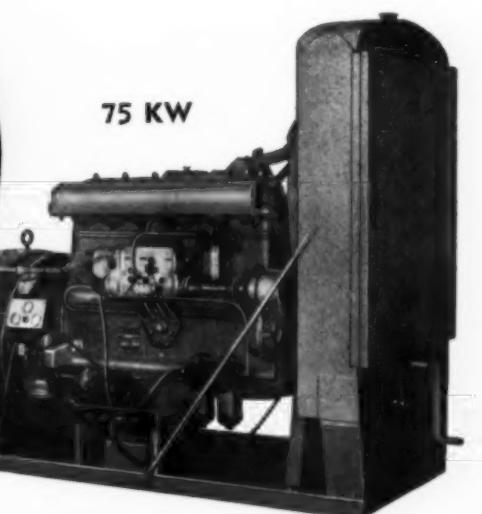
PARK Shipyards, Ltd., Vancouver, B. C., have delivered to Captain Jack McKenzie a 58-foot fishing boat powered with a 68 hp. Cummins Diesel. This makes the second Cummins installed by this yard in thirty days.



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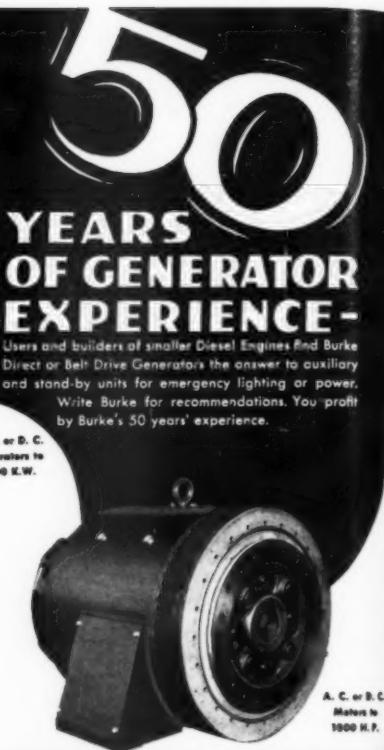
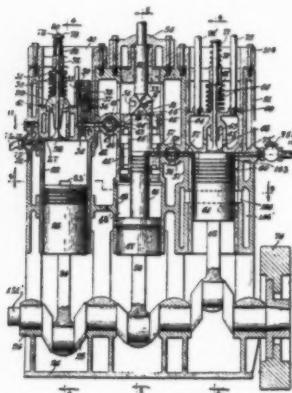
Vibration Control
STEEL SPRINGS - CORK - RUBBER
KORFUND
COMPANY
48-28 THIRTY SECOND PLACE
LONG ISLAND CITY, N.Y.

LATEST DIESEL PATENTS

A description of the outstanding patented inventions on Diesel and Diesel accessories as they are granted by the United States Patent Office. This information will be found a handy reference for inventors, engineers, designers and production men in establishing the dates of record, as well as describing the important Diesel inventions.

Conducted by C. CALVERT HINES

2,309,968
TWO-CYCLE, SUPERCHARGED,
COMPOUND, DIESEL ENGINE
Francis Marburg, Odessa, Fla.
Application December 4, 1939, Serial No.
307,495
23 Claims. (Cl. 60—15)



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A special FINE valve grinding or finishing compound recommended by Mfrs. and users of diesel engines for "lapping in" or "finishing" injector seats and injector valves. Trial can \$1.00 prepaid
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719-23 NATL. CITY BANK BLDG. . . . Mechanical Engineer . . . CLEVELAND 14, OHIO

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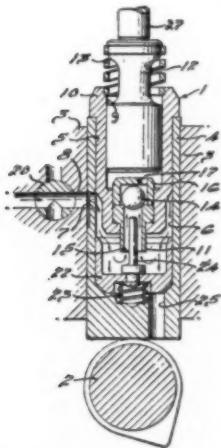
said high pressure power piston, the engine having an automatically controlled scavenging- and supercharging-air-overflow port between said air compressor unit and said high pressure power unit and having a high pressure power piston controlled gas- and air-overflow port between said power units and having an automatically controlled exhaust port for said low pressure power unit, the said units being arranged in series and in open communication with each other by way of said overflow ports during a portion of the air compressor unit compression stroke while said exhaust port is open simultaneously, the relative crank-angles of the engine and the air-pressure produced within said air compressor unit during the said portion of said compression stroke, and the said ports, being so arranged and controlled, that scavenging- and cooling-air is flowing from said air compressor unit during the said portion of said compression stroke through said high pressure power unit and successively through said low pressure power unit and through said open exhaust port, producing powerful scavenging and internal air-cooling of the high pressure power unit, whereupon said gas- and air-overflow port is closed, producing successively high supercharging and additional, internal air-cooling of and compression within the high pressure power unit, whereupon said air-overflow port is closed and said high pressure power unit piston produces higher compression solely within the high pressure power unit, the engine having a separate port serving as a fuel-inlet port and terminating into the compression chamber of the high pressure power unit.

2,309,740

INTERNAL COMBUSTION ENGINE
Carl Voorhies, Detroit, Mich., assignor to Eaton Manufacturing Company, Cleveland, Ohio, a corporation of Ohio

Application July 24, 1941, Serial No. 403,849

9 Claims. (Cl. 123-90)



5. A hydraulic valve tappet comprising in combination, a tappet body having a longitudinal bore closed at its lower end and open at the upper end and adapted to receive operating liquid, the lower part of said body including a liquid reservoir, a hydraulic compensating mechanism received in the open upper end of said bore, valve means in the hydraulic mechanism regulating liquid movement thereto, a valve controlled passage regulating flow of operating liquid into the reservoir in said bore, means in the liquid reservoir for rendering inoperative the valve means in the hydraulic compensating mechanism, said means in the liquid reservoir normally rendered inactive by pressure of the operating liquid and active upon closing movement of the valve controlled passage regulating flow of operating fluid into the tappet reservoir to effect shortening of the compensated length of said tappet.



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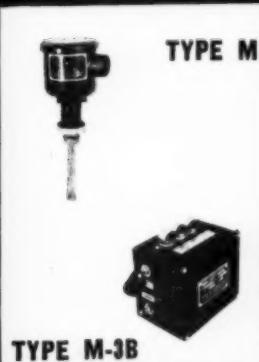
Build the pump directly into the design of your machine and save space, material and money. For this purpose Tuthill provides positive-displacement, internal-gear rotary pumps in stripped form. Capacities from 1 to 50 g.p.m. for coolant, lubrication, hydraulic and liquid transfer service. Write for Tuthill Stripped Pump bulletin.

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With this varied gasket experience, it is likely that Fel-Pro has already encountered your problem, and has the answer ready in one of the many gasket materials in the Fel-Pro line. If not, then Fel-Pro engineers are well-equipped to develop a special material designed to overcome your difficulty. Write Fel-Pro's Engineers who will be glad to advise you.

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New York
AN ENGINEERING SERVICE

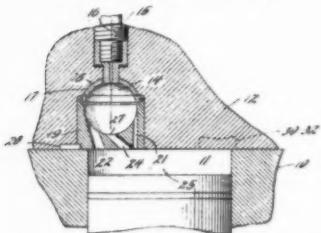
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BLOOMFIELD, NEW JERSEY

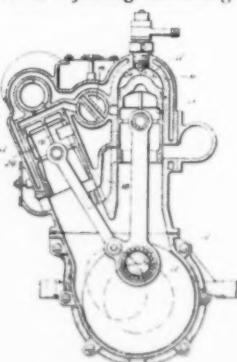
2,324,328
COMBUSTION CHAMBER
Richard H. Sheppard, Hanover, Pa.
Application November 1, 1941,
Serial No. 417,532
5 Claims. (Cl. 123-32)



2. An insert element for a Diesel engine consisting of a one-piece body having: a fuel receiving chamber therein, two end surfaces adapted to engage the engine block and the cylinder head respectively whereby expansion by the body when heated tends to force the head and block apart, and a relief groove generally parallel to the plane of engagement of the engine block and cylinder head; such construction permitting the body to be made exactly the same length as the hole into which it fits so as to avoid the building up of carbon deposits which occurs if allowance for expansion is made.

2,324,071
METHOD OF FUELING SOLID FUEL
INJECTION ENGINES
Max George Fiedler, Media, Pa., assignor to
Fiedler-Sellers Corporation, Philadelphia, Pa.,
a corporation of Pennsylvania
Continuation of application November 12, 1937,
Serial No. 174,238. This application January
2, 1941, Serial No. 372,915. In Canada April
5, 1937
3 Claims. (Cl. 123-27)

3. The method of fueling variable speed solid fuel injection auto ignition engines of the reciprocating piston type comprising, supplying air to the engine's cylinders in such quantities that the maximum temperature due to compression is below the decomposition temperature of the fuel, instantaneously injecting fuel into the cylinder after the attainment of compression ignition conditions within the cylinder at a rate such that, regardless of the quantity of fuel or of the engine speed, the entire charge is injected within 10° of crank travel and during the ignition lag period, injecting the charge at a time



such that the injection of the fuel is completed prior to the attainment of maximum compression in the cylinder and prior to initial ignition of the fuel and injecting the fuel charge through an orifice of such size that it does not constitute a restriction to the passage of fuel and at a pressure of the order of 1200 pounds per square inch preventing atomization whereby the fuel enters the combustion space in the form of wet globules of a size sufficiently large to prevent vaporization during the period of injection and ignition lag.

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Machinery Co., Inc.

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Marine Auxiliary Units

MANZEL
FORCE FEED
LUBRICATORS
for Most Efficient Diesel Lubrication



10-Feed, Model 94

Every Manzel Lubricator incorporates the knowledge and experience gained in nearly 50 years of specializing on lubricators. That's why Manzel Model 94 Lubricators are standard equipment on leading makes of Diesels.

Of simple design and sturdy construction they pump against the highest pressure used in Diesel engine cylinders. And they deliver positive, dependable lubrication throughout the engine's life.

Write for catalog 94-8

MANZEL BROTHERS CO.
275-277 WABECK STREET
BUFFALO, N.Y.

Penn Points



Protect your investment,
avoid costly shut-downs,
with Penn Automatic Con-
trols for Diesel engines.
Write for Bulletin E100.

PENN ELECTRIC SWITCH CO.
GOSHEN, IND.

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, VALVES,

NY, INC.
Orleans, La.

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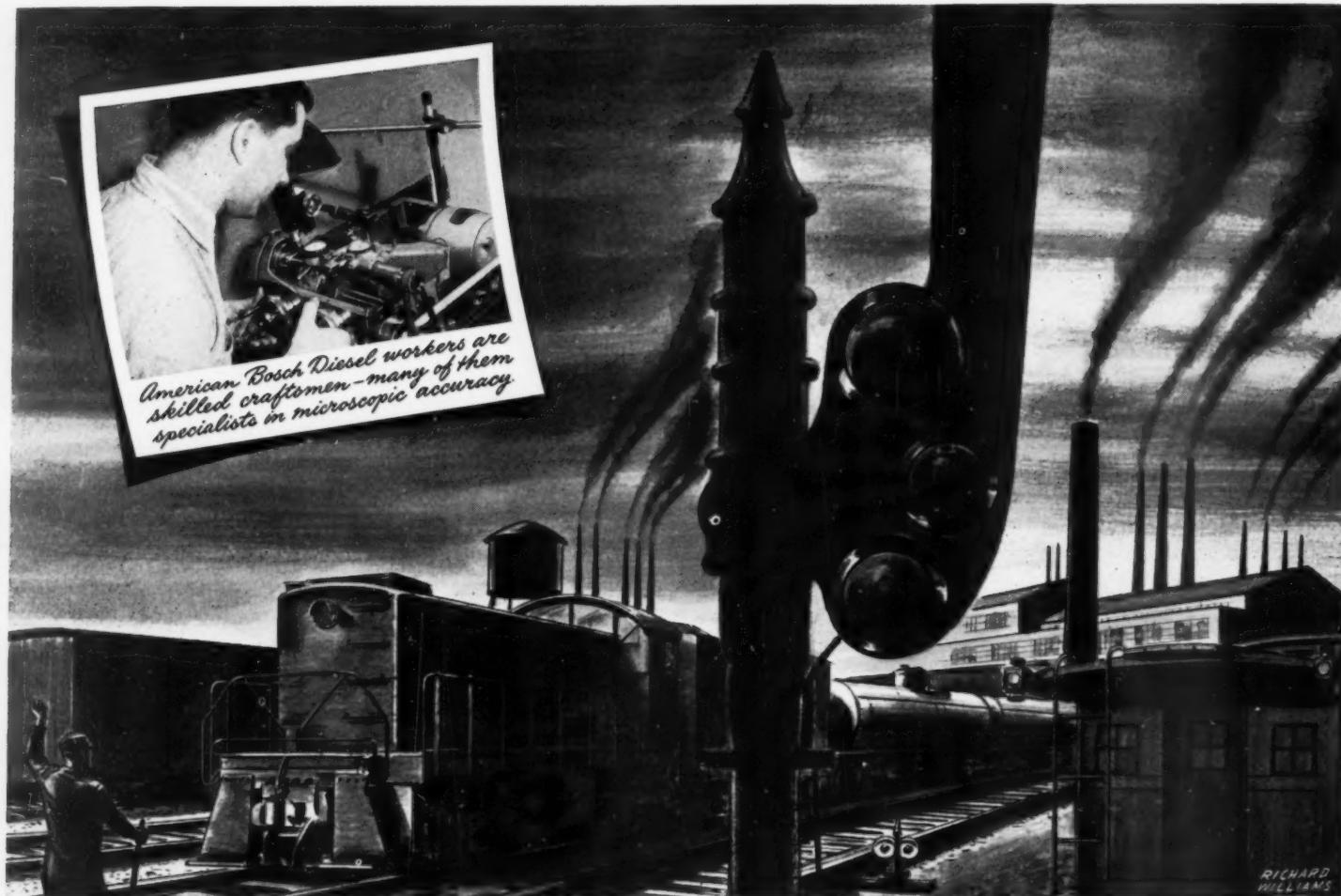
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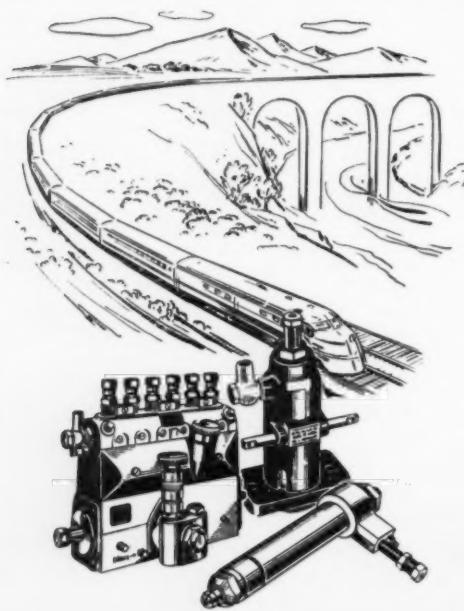
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The "Iron Horse" That Feeds on Oil



DIESEL locomotives are the choice of many railroads today for service on streamliners and as switchers in the yards. Metering out the diet of many of these "iron horses" that feed on oil is American Bosch fuel injection equipment.

Other types of Diesel engines are serving America at war, at home and abroad, on land and sea. In close touch with all phases of this great industry, American Bosch design, engineering, and manufacturing facilities serve a majority of the Diesel engine builders of America.

AMERICAN BOSCH CORPORATION • SPRINGFIELD, MASSACHUSETTS

AMERICAN BOSCH

AVIATION & AUTOMOTIVE ELECTRICAL PRODUCTS . . . FUEL INJECTION EQUIPMENT

MODERN CRAFTSMEN IN THE NEW ENGLAND TRADITION



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and
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STU

The Engines that Drive the Invasion Barges: **Gray-Marine Diesels!**



First Awarded Dec., 1942.
Awarded Again June, 1943.

OFFICIAL HIGGINS INDUSTRIES PHOTO



GRAY
MARINE
MOTORS
GASOLINE
DIESEL

Used in the Navy's 36-foot Landing Boats, the 50-foot Tank Lighters and the Sea Going 105-foot LTC's. These are the Series 71 General Motors two-cycle Diesel Engine, adapted and equipped for marine propulsion by Gray.

FIVE BASIC SIZES, USING INTERCHANGEABLE PARTS

1 cylinder	2 cylinder	3 cylinder	4 cylinder	6 cylinder
25 HP	55 HP	82 HP	110 HP	165 HP

Both rotations: Reduction Gear Ratios 1.5:1, 2:1, 3:1 and 4.4:1.

Fresh water cooling on all models • Thermostatic temperature control • Direct injection—no high pressure fuel lines • Two-cycle efficiency and low weight • "Air blast" internal cooling • Blower scavenging • Oil cooled pistons • Governed idling speed

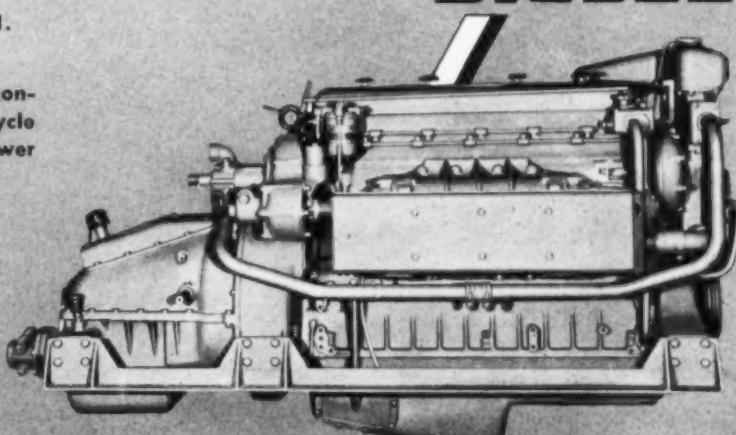


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Valve and Injector Operating Mechanism
Lubricating Oil System
Air Intake System
Fuel System and Injectors
Governor
Water Circulation
Electrical System
Clutch and Reverse Gear
Trouble Shooting

This instruction manual for Gray Marine Diesel is typical of Gray's Technical Literature. Size 8½ x 11, 275 pages, over 400 illustrations. Price to General Public \$3.50; price to men in the U. S. Armed Forces \$2.00. Write for complete list of Gray's practical manuals.

Six-cylinder Gray Marine Diesel, the engine which has done such an outstanding job in the Solomon Islands, in the Aleutians, in the Mediterranean and in lighterage work all over the world.



GRAY MARINE MOTOR COMPANY

Marine Engine Specialists—Gasoline and Diesel

DETROIT 7, MICH., U. S. A.

YOU DON'T HAVE TO WAIT FOR DOUBLE SEAL PISTON RINGS



Write, Wire or Phone

your nearest Double Seal Distributor or The Double Seal Ring Co.

IMMEDIATE SHIPMENT

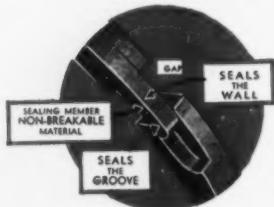
Your order for either Double Seal Rings or plain rings is usually shipped from stock the same day the order is received at the factory or within 3 to 10 days for rings that must be made-to-order.

500,000 RINGS IN STOCK

To serve our customers and distributors in any emergency we maintain a stock of approximately 500,000 rings in sizes from 1" to 96" in practically all types. A great many piston ring requirements can be met with rings from stock. When you order from The Double Seal Ring Co., you are reasonably sure of having your rings within a few days.

3 MANUFACTURING PLANTS

Double Seal Ring users in every part of the United States enjoy the advantage of being *only one day* by Air Express from one of the *three* Double Seal Piston Ring Factories strategically located in New York City, Fort Worth, Texas, and Los Angeles, California. These factories have sufficient



TO PISTON RING DISTRIBUTORS

There are some territories now open in which a competent Machine Shop, Manufacturers' Agent or Industrial Sales Representative can render valuable service and make substantial earnings as a distributor of Double Seal Rings. No investment required or inventory to carry. Write for complete information.

DOUBLE SEAL RING CO.
GENERAL OFFICES — FORT WORTH, TEXAS
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2065 Montgomery St., Fort Worth, Texas — 157 Chambers St., New York, N. Y.
6201 Wilmington Avenue, Los Angeles, California.

capacity to produce any reasonable number of made-to-order rings for immediate shipment, and each factory offers service facilities to all essential users and distributors of industrial piston rings.

NATION'S FASTEST PISTON RING SERVICE

Expanded production facilities plus day and night operation enable us to fill a large volume of Government orders for Double Seal Rings without appreciably slowing our usual prompt shipment to essential civilian users. Customers tell us that our shipment of made-to-order rings within 3 to 10 days, which we are now regularly making, is by far the fastest piston ring service available anywhere today.

DOUBLE SEAL RINGS ARE GUARANTEED

Double Seal Piston Rings are guaranteed to give you complete satisfaction—you to be the sole judge of their performance. If they do not function as you think they should, we will furnish new rings without additional cost or refund the entire purchase price—without argument or delay.

MAIL THIS COUPON TODAY

DOUBLE SEAL RING CO., Box 566-P, Fort Worth 1, Texas.

Please send, without cost or obligation, the items checked.

- Specification forms, so I may obtain recommendations and quotation on Double Seal Rings for my equipment.
- The Double Seal Piston Ring Handbook for Engineers.
- Facts and figures on how Double Seal Rings can save me money.

Name _____ Title _____

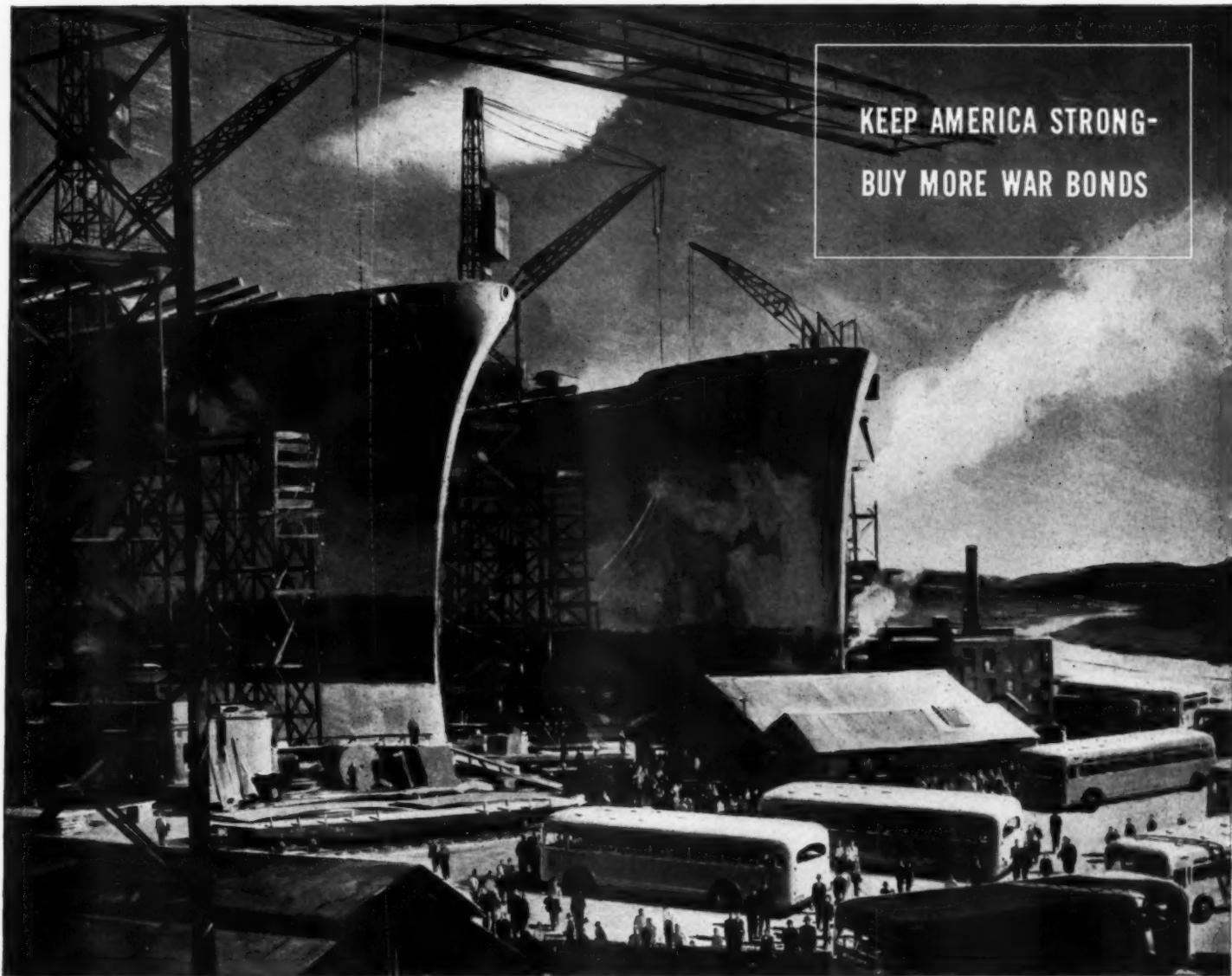
Firm _____

Address _____

City _____ State _____







PEACETIME TRANSPORTATION ON A WAR JOB



Nearly every Diesel engine General Motors makes now goes to work for Uncle Sam.

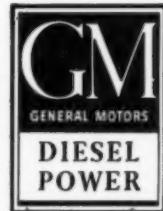
Most of them go right into the fighting—into tanks, trucks and tractors, into combat ships, patrol boats and landing barges.

But here are GM Diesels doing a big wartime job in a home front application.

It's a Navy "task force" of some 250 General Motors Diesel coaches that carry thousands of Mare Island Navy Yard workers in California to and from the job every day over a fifty-mile radius.

These are doing the same day-in-day-out dependable job which thousands of GM Diesel-powered coaches were doing before.

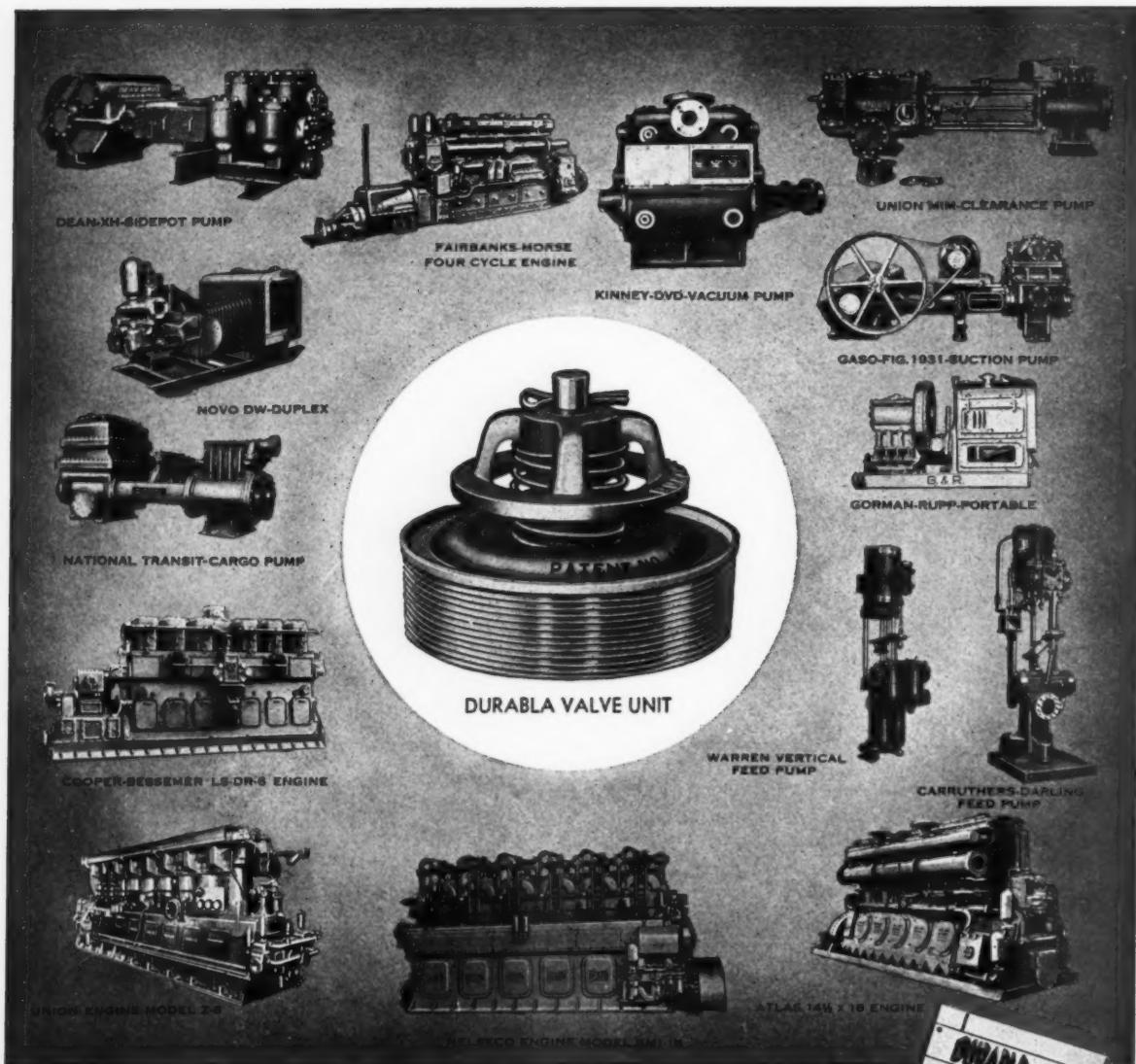
And they point to the days ahead when General Motors can devote its expanded plants to providing bus operators with engines and parts improved and refined through their work at war.



ENGINES ..15 to 250 H.P... DETROIT DIESEL ENGINE DIVISION, Detroit, Mich.

ENGINES ..150 to 2000 H.P.. CLEVELAND DIESEL ENGINE DIVISION, Cleveland, Ohio

LOCOMOTIVES ELECTRO-MOTIVE DIVISION, La Grange, Ill.



**All of these Diesel Engines, Pumps and Compressors are
factory-equipped with DURABLA Valve Units.**

**DURABLA Valve Units are furnished, ready for immediate
installation in any make of Engine, Pump or Compressor
handling either Liquid or Gas.**



Bulletin No. 913PD

*Address the DURABLA Engineering Department
for information*







Hail to the
BLACK GANG



... The guys that keep 'em goin' !



GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

THE NILES TOOL WORKS CO.

THE HOOVEN, OWENS, RENTSCHLER CO.

GENERAL MACHINERY ORDNANCE CORPORATION



HOW TO SOLVE

Operating Problems

with *Correct Lubrication*

Fight Heat, Pressure, Oxygen

PROBLEM: Heat, pressure, oxygen attack a Diesel lubricant between the faces of the rings and the cylinder wall (1, above) and between the rings and grooves (2, above). Its use as a coolant (3, above) also subjects it to oxidation. The lubricant must resist these attacks or it will form deposits, interfering with ring action and piston cooling.

ANSWER: A line of famous Gargoyle Oils is made specifically for this purpose: *Gargoyle D. T. E. Oils Nos. 1 to 5*. In even the most severe Diesel operation, these oils resist oxidizing influences. They form a tenacious film that resists the wiping action of the piston rings. Wear, ring breakage and blow-by are all minimized. Piston cooling remains at maximum efficiency.

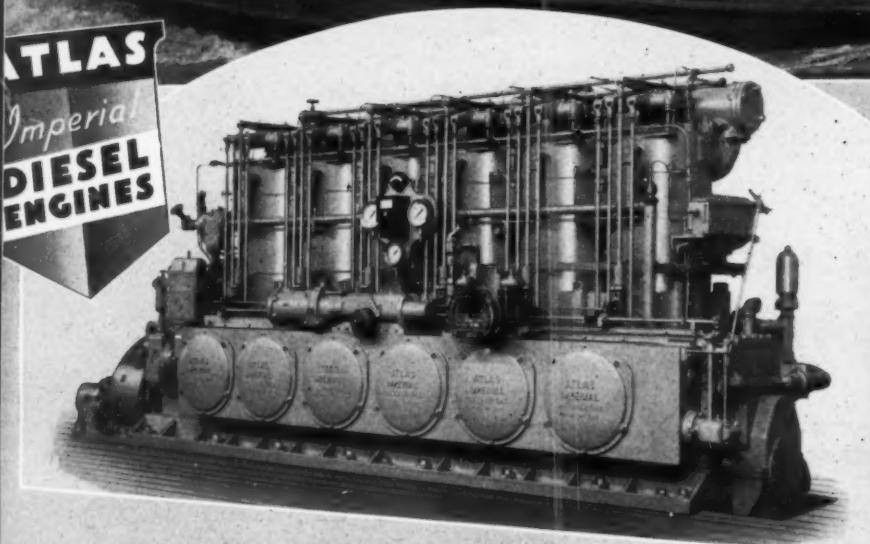


SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div.
White Eagle Div. • Wadham's Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp.

CALL IN SOCONY-VACUUM



Adopts Proven Design



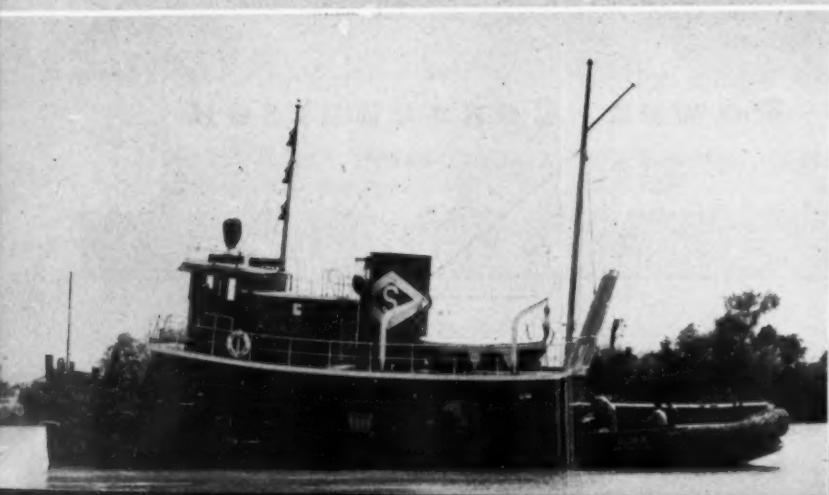
The 400 H.P. heavy duty, slow speed ATLAS DIESEL which powers these and hundreds of other tugs plying all waters of the United States

Below, the "AJAX," another of the large fleet of Atlas powered tugs operated by the Sabine Towing Company of Port Arthur, Texas



Above, the "YN-54," operated by the United States Navy

The "PAN-SIX," one of a fleet of Atlas powered tugs operated by the Pan American Petroleum & Transport Company



Transportation Corps



When the Transportation Corps of the U. S. Army realized the magnitude of the job that was placed squarely in their lap—getting men and matériel in unheard-of quantities to the four corners of the globe, they knew that such a job required reliable, time tested transportation—and NOW!

The 74' all steel welded tugs, powered by 400 H.P. slow speed, heavy duty Atlas Diesels, were developed by the Levingston Shipbuilding Company of Orange, Texas, and in the hands of Gulf Coast Petroleum Transporters and tugboat operators had proven eminently successful and dependable. The Transportation Corps liked their performance—and adopted them "as is."

As the shipbuilding program expanded, arrangements were made with the Levingston Company to have their designs used by all other shipyards building these tugs for the Transportation Corps. Atlas Diesels—the engines which commercial operators prefer—long since earned their stripes for dependability in such crucial operations.

ATLAS IMPERIAL DIESEL ENGINE CO. OAKLAND • CALIFORNIA

NORTHWESTERN DIVISION . . . SALMON BAY TERMINAL, SEATTLE, WASH.
EASTERN DIVISION . . . 115 BROAD STREET, NEW YORK, N.Y.
CENTRAL DIVISION . . . 228 NORTH LA SALLE STREET, CHICAGO, ILL.
SOUTHWESTERN DIVISION . . . 3726 NAVIGATION BOULEVARD, HOUSTON, TEX

"CROWN CENTRAL" owned by Crown Central Petroleum Company of Houston, Texas



The "GOLIATH," owned and operated by the Sabine Towing Company of Port Arthur, Texas



The Army-Navy "E," awarded for outstanding performance in war production flies over both the Eastern and Western factories of Atlas Imperial Diesel Engine Co.



POWER! wins battles...man-power, fire-power and *fighting horse-power!*



THE STEEL
MILLS NEED
MORE SCRAP!
SEND YOUR
SCRAP TO
WAR!

Fighting horse-power, designed by American engineers, built by American craftsmen, driven or flown by American youth—has no match on this earth.

Americans, cradled in the family car literally since babyhood, are the most motor-wise lads on earth. They take to anything from a jeep to a thirty-ton tank-transporter like a Briton to his beef. They'll fly and fight a four-motored bomber as naturally as their ancestors fought with flintlocks.

It's a privilege and an honor to have a hand in equipping these fighting young men with the magnificent tools of Victory created for them by American engineering. Sealed Power piston rings by millions are safeguarding precious engine power on land, sea and in the air.

Our engineers are working closely and effectively with those of leading manufacturers of Diesel Engines.

SEALED POWER CORPORATION

Muskegon, Michigan • Windsor, Ontario

PISTON RINGS—PISTONS—CYLINDER SLEEVES



Which do your Diesels need— Detergent or Non-Detergent Oils?

- Ask any old-time operator. He'd say, "Every Diesel has its own personality." He'd probably add, "Take our No. 4. She's a cranky old devil—needs a lot of cleaning and fussing. Now, No. 1, here, is as smooth as a cat's purr. No trouble from one year's end to the other."

Why are there such differences in performance? Obviously, one reason is that makes and models of engines differ. Furthermore, no two Diesel installations are exactly alike. But that doesn't mean you can't get clean, trouble-free service from any Diesel if you find the real cause for cranky or excessively dirty operation.

An important step towards clean operation is the recent development in Nonpareil Diesel Oil. Three new, heavy-duty grades with remarkable detergent properties have been added to the line.

Regular Nonpareil (non-detergent) has been lubricating stationary Diesels in the Middle West for 15 years. One plant man after another can point to his equipment and say, "We have had less trouble from ring sticking, dirty exhaust, etc. with Nonpareil than with any other oil tried." Records like the Litchfield operation above—8,000 hours without a

Now these reports are coming in even on the toughest lubrication jobs where Nonpareil H.D. is used, like the Farmers & Merchants Milling Company equipment example cited at right. Nonpareil H.D. not only eliminated ring sticking, but reduced exhaust port carbon—which was being cleaned every two weeks—to practically nothing.

A Standard Oil Engineer is in the unique position of being able to recommend a detergent-type or non-detergent-type oil—whatever best suits your engine requirements. Call the nearest Standard Oil Company (Indiana) office, or write 910 S. Michigan Ave., Chicago 5, Illinois. In Nebraska, call Standard Oil Company of Nebraska for the Engineer nearest you.

Mr. W. W. Viebahn, superintendent of the Utilities Department of the City of Litchfield, Minnesota, summarizes his experience with Nonpareil Diesel Oil as follows:

"Our 1400 h.p. Model 33D, Fairbanks-Morse Diesel engine was recently overhauled after a little over eight thousand hours of operation. This engine operated on Nonpareil Diesel Oil and the cylinders and pistons were found to be in excellent condition. There were no stuck or broken rings. The two top rings were worn somewhat and were replaced. This engine has been in operation on Nonpareil Diesel Oil since it was installed in 1938.

"We appreciate the engineering service rendered by Mr. Frank Calton, your lubrication engineer. Mr. Calton has been very prompt in assisting us with our lubrication problems."

Superintendent W. W. Viebahn, is shown in the foreground, and Alfred I. Raymond at right, beside the 1400 h.p. Diesel at Litchfield.



Glenn J. Tollefsbol, in charge of the Farmers & Merchants Company Diesel Plant, Glencoe, Minnesota, reports three improvements that were made on their Diesel operation when Nonpareil H.D. Diesel Oil Medium was used:

"Since we started using your Nonpareil H.D. Diesel Oil Medium, the operation of our Diesel engine has been greatly improved. Prior to the use of this oil, it was necessary to clean the exhaust ports at least every two weeks, and now the exhaust port carbon is almost nil. We have been able to cut back the lubricators 20% and still have better lubrication than with the old oil. Considerable trouble was experienced with stuck rings before changing to Nonpareil H.D. Diesel Oil, Medium, but the last inspection showed that the rings were all free and well lubricated."

Oil is Ammunition . . . Use it Wisely

STANDARD OIL COMPANY (INDIANA)

**STANDARD
SERVICE**

★ LUBRICATION ENGINEERING

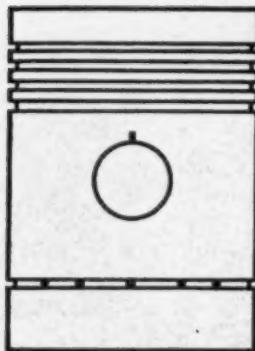




WEIGHT SAVING WITH ALUMINUM FORGINGS



Why not forged



aluminum pistons,



or connecting rods ?

They're forging an airplane engine crankcase here, forging it of aluminum to get the light weight, high strength and dependability so vital to our fighters' success and safety.

As Diesel engines operate at higher speeds, as demands for more and more power continue to rise, the need for parts having this combination of properties—light weight, high strength, dependability—will also become urgent. That's why engine

manufacturers are now considering what Alcoa Aluminum forgings will accomplish in the engines they're designing for your postwar use.

Practices developed by Alcoa for quantity production of wartime products, and for making larger size forgings, will be made available to Diesel engine builders just as soon as metal-manufacturing facilities can be spared for peacetime production. **ALUMINUM COMPANY OF AMERICA, 2141 Gulf Bldg., Pittsburgh, Pa.**

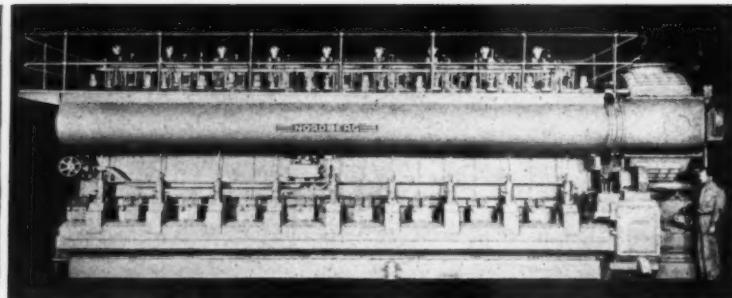


ALCOA · ALUMINUM





STAMINA[†]



The SEA WITCH is powered by two Nordberg 3000 hp. marine Diesels, like the unit illustrated. These Diesels are equipped with SATCO[®] bearings that match Diesel Stamina.



When the marine sagas of this war can be written, that of the SEA WITCH will rank high in almost incredible achievement. We shall see how this vessel went straight from her builders into the very teeth of the enemy — unescorted — confident in her sheer speed and Stamina and how these inbuilt qualities enabled her to shuttle repeatedly through enemy infested waters on missions of mercy and aggression.

†According to Webster: Vigor; Capacity for Enduring.

* Trade Mark Registered.

AMERICAN BEARING CORPORATION

INDIANAPOLIS

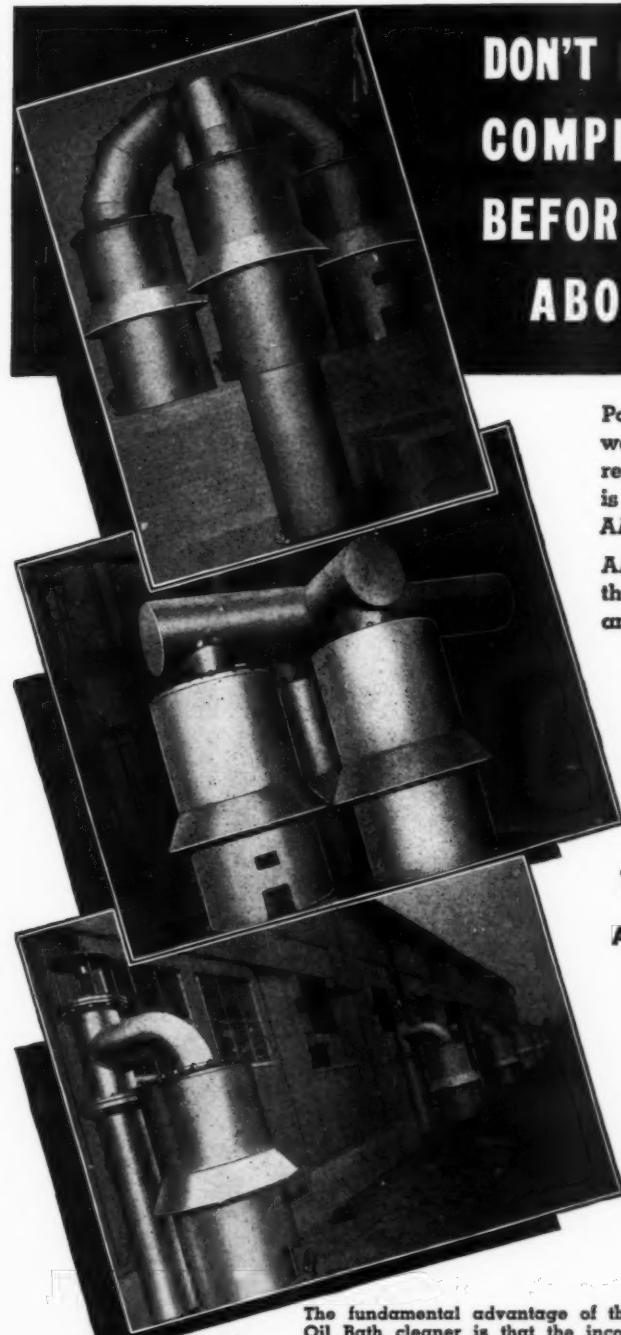


INDIANA





DON'T MAKE YOUR ENGINES OR COMPRESSORS *Call Quits* BEFORE YOU DO SOMETHING ABOUT AIR CLEANERS!



AMERICAN AIR FILTER CO. INC.
405 Central Avenue, Louisville, Kentucky
In Canada: Darling Bros., Ltd., Montreal, P.Q.

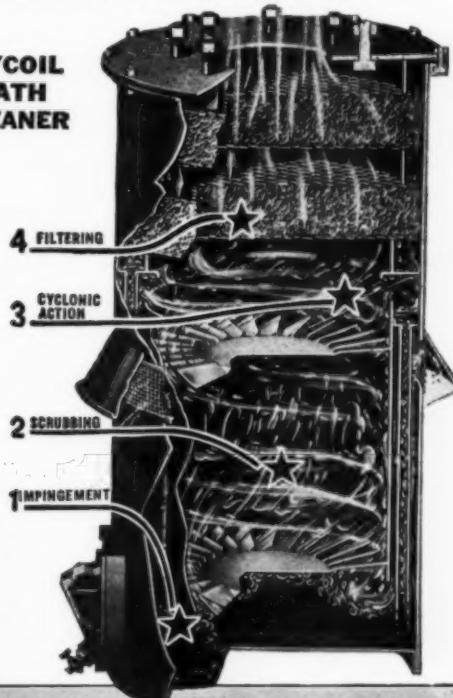
AAF

Power plants are too precious and important to the war effort today, to risk unnecessary shut downs for repairs—especially when such a small investment as is needed to equip engines and compressors with AAF air cleaners will eliminate most of the causes.

AAF air intake filters are in use on power equipment throughout the nation—protecting valves, cylinders and pistons against excessive wear due to dust and grit. Bulletins describing the entire line of AAF filters are available on request.

Shown on this page are photographs of several Cycoil installations. This air cleaner is outstanding because of its unique 4-way cleaning principle described below. Ask for Bulletin No. 130D.

THE CYCOIL OIL BATH AIR CLEANER

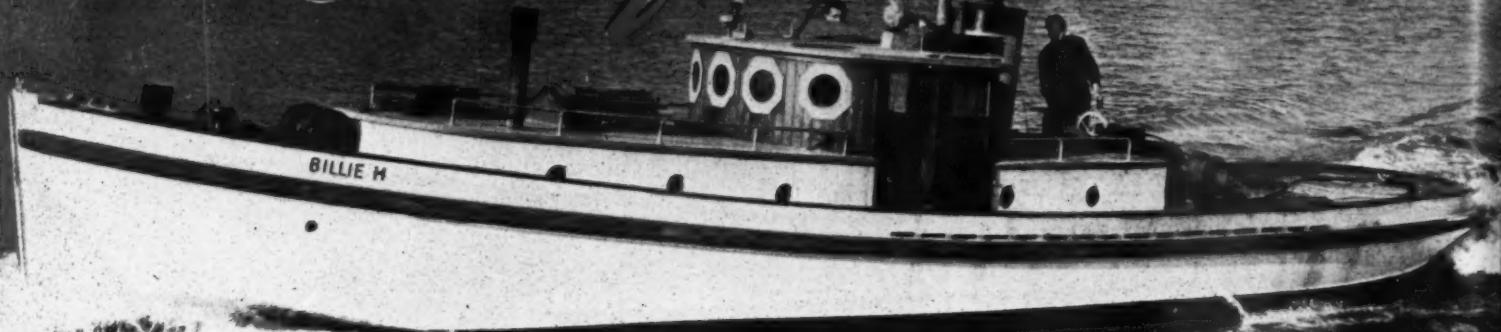


The fundamental advantage of the Cycoil Oil Bath cleaner is that the incoming air stream picks up an unusually large quantity of oil which is thoroughly mixed with the air (causing a scrubbing or precleaning action), and then thrown out by centrifugal action before the air stream enters the filter cell. This results in reducing the dust load on the filter cell and insuring continued self-cleaning action.



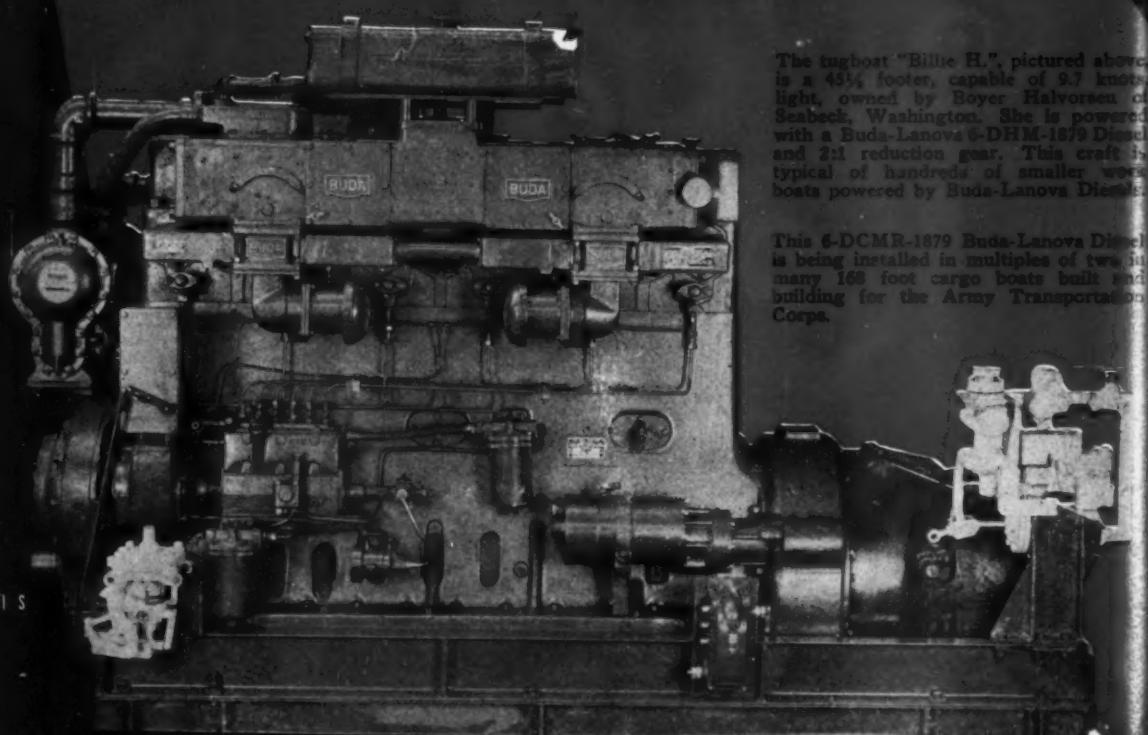
AMERICAN AIR FILTERS for ENGINES and COMPRESSORS

On the Waterfront



BUDA-LANOVA Marine Diesel

The Buda Company has been building modern 4-cycle Diesels since 1926 and Buda-Lanova "Low-Pressure" Diesels have been proved and accepted for all types of applications on land and sea. The low pressure and prolonged "soft" combustion, as brought about in the Lanova system, compares with the steady push of a steam engine. This means easier operating stresses on pistons, rods, bearings, crankshafts—longer overall engine life—greater operating economy—More Horsepower Hours Per Dollar.



The tugboat "Billie H.", pictured above, is a 45½ footer, capable of 9.7 knots, light, owned by Boyer Halvorsen of Seabeck, Washington. She is powered with a Buda-Lanova 6-DHM-1879 Diesel and 2:1 reduction gear. This craft is typical of hundreds of smaller work boats powered by Buda-Lanova Diesels.

This 6-DCMR-1879 Buda-Lanova Diesel is being installed in multiples of two in many 168 foot cargo boats built and building for the Army Transportation Corps.

**THE
BU DA
CO.**

ESTABLISHED 1881
HARVEY CHICAGO SUBURB ILLINOIS

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The Navy knows the Answers

In our Navy, the world's most formidable fighting machine, Diesel-powered craft of all kinds are lubricated with Standard of California's RPM DELO. The answers in this naval quiz tell you why. They'll solve your problems on how to squeeze more efficiency out of your Diesels—and cut maintenance costs.

Q. Can a submarine drown in air?

A. Yes. Her Diesels "breathe in" great quantities of air which cause ordinary oils to turn gummy, stick rings and hasten engine failure. In today's subs, RPM DELO eliminates this ring-sticking, reduces sludge and deposits—greatly increases cruising range.



Q. How do you put a bone in the teeth of a DE?



A. Powerful Diesels put that speed wave under the bow of a Destroyer Escort. With RPM DELO lubricating her big engines and keeping them at top efficiency, a Destroyer Escort can sprint like a race-horse, even at the end of a long convoy trip.

Q. What is the most explosive part of a minesweeper?

A. Her engine. Thousands of times a minute, fierce explosions sear her cylinders. But they're safe with RPM DELO because it contains special additives that make it cling to hot spots, give constant point-of-wear protection, even under most severe conditions.



Q. What is the most important duty of a landing barge?



A. To keep in action—because a beachhead breakdown could be disastrous. RPM DELO in a landing boat's Diesel gives it extra protection against breakdowns. RPM DELO often cuts Diesel repair bills in half, doubles the time between overhauls, minimizes wear.



RPM DELO is marketed under the following names: RPM DELO • Caltex RPM DELO
Kyo RPM DELO • Signal RPM DELO • Imperial-RPM DELO • Sohio RPM DELO
CONCENTRATE

STANDARD OIL COMPANY OF CALIFORNIA

Ask your Diesel engine manufacturer or distributor for the RPM DELO supplier in your vicinity



Where PBY's
Come Home
to Roost

United States Seaplane Tender

Powered with
FAIRBANKS-MORSE
DIESELS





PIERCE KEEPS THE SPEED CONSTANT ...PROTECTS THE POWER UNIT!



HOW TO MAKE YOUR GOVERNORS LAST!

Like others manufacturing for war needs, Pierce production is for war and essential industry. For this reason new governors can be supplied only on a priority basis. But Pierce calls attention to these easy measures which will make your present Pierce Governors last and give the best service.

- CLEAN GOVERNORS once a month with kerosene, gasoline, or prepared cleaner.
- INSPECT AND CHECK GOVERNORS each week when in continuous operation.
- CHECK OIL LEVEL every day in manually lubricated governors. Use the same grade oil as recommended for the engine.
- LINE UP driving pulleys or gears accurately when reassembling governor after cleaning.

Should your governor need repair or reconditioning send it to the factory with the necessary preference rating certificate.

★ You'll find Pierce Flyball Governors in use on every type of Diesel operation . . . industrial, automotive or marine . . . keeping the engine speed constant . . . assuring operators exactly the right amount of power for the work to be done.

You can depend on Pierce to provide split-second control of the power unit at all times. Variances which may occur in the load factor are instantly and automatically compensated for by the Pierce Governor . . . to give efficient, economical operation, and protection of the power units. Two types of governors are available, driven either independently of the fuel pump, or directly from the fuel pump shaft.

Built by the world's largest governor manufacturer, Pierce Flyball Governors are precision instruments, built carefully and sturdily to last a long, long time.

THE PIERCE GOVERNOR COMPANY, INC., 1603 Ohio Avenue, Anderson, Indiana

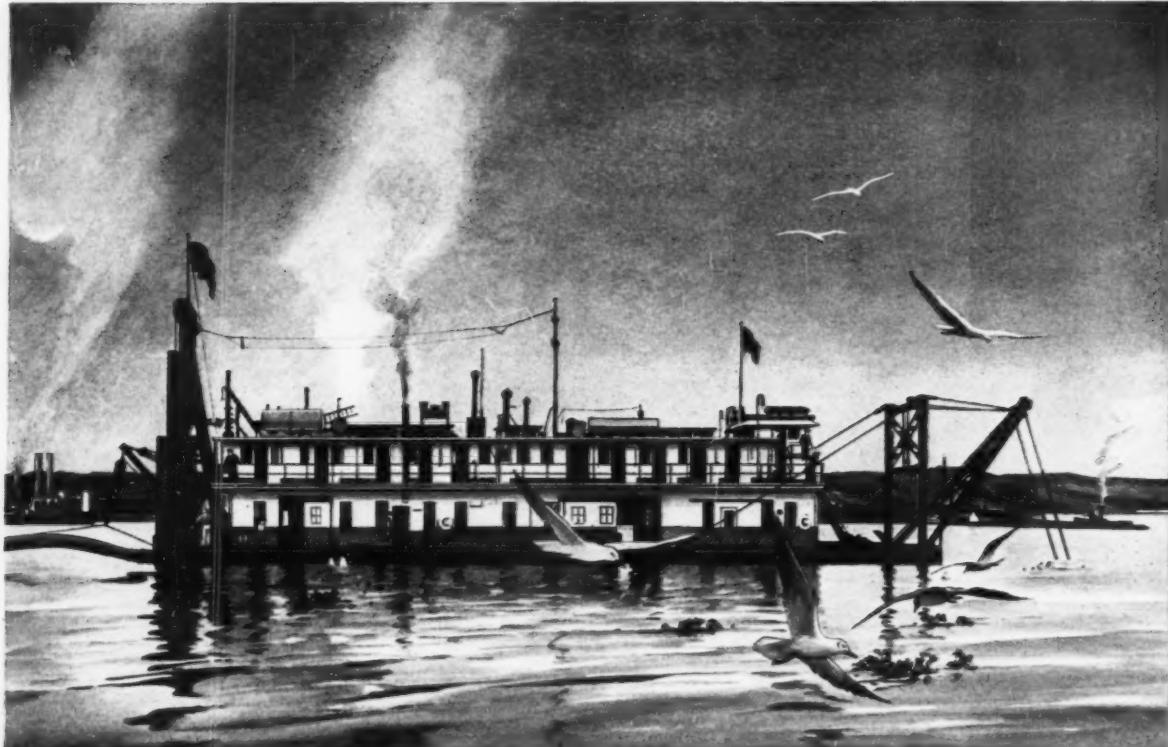
NOW... and after the war... insist on Pierce Flyball Governors
when you purchase new equipment!

Pierce Governors

STANDARD SINCE 1913

WHAT!

FLUID DRIVE A DREDGE PUMP?



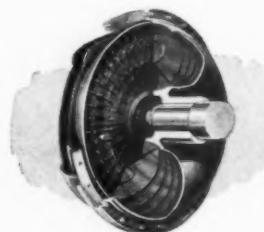
U. S. Engineer's Dredge Pullen equipped with American Blower Fluid Drives.

The use of American Blower Fluid Drives is not limited to U. S. warships, cargo vessels, submarines and planes. Quite the contrary. Here is an installation on a U. S. Engineer's Department Dredge.

Here, too, the principle of Fluid Driving through a Hydraulic Coupling prevents transmission of torsional vibrations, provides a convenient means of declutching, and protects the Diesel engine and dredge pump from shock loads.

American Blower Fluid Drives are not a new development. They have proved their merit in ships, in fan control for mechanical draft, on oil rigs, in war planes and in many other types of work.

After Victory, Fluid Drives, built by American Blower, the pioneer and developer of this type of equipment in America, will be available for incorporation in your post-war products.



Cutaway view of American Blower Fluid Drive. There is no mechanical connection between driving and driven members.



AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of AMERICAN Radiator and Standard Sanitary Corporation

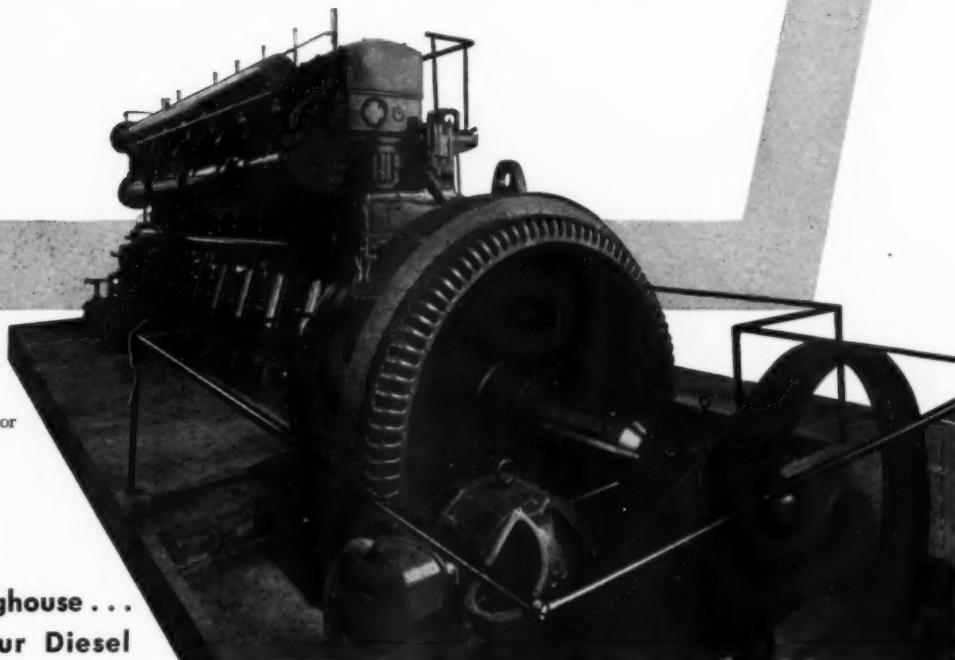






How your Diesel-driven generator can deliver maximum performance

Worthington
Diesel Engine
driving 875 KV-A
Westinghouse Generator



Specify Westinghouse . . .
it matches your Diesel

In 1886—56 years ago—Westinghouse introduced the first A-C generator ever used in this country, to convert mechanical power into electrical power. Since then, thousands have been constructed by Westinghouse—*are in daily use*.

And since the coming of the Diesel engine, additional thousands have been built—each one, like its forebears, *exactly matched* to the electrical traits of the engine drive—to give the greatest degree of efficiency of generation.

In the Westinghouse A-C Generator, as it stands beside your Diesel today, there's a wealth of engineering talent, inventive

genius and seasoned experience—a generator designed for that particular Diesel engine—a combination that functions like a single unit.

There's no magic connected with the outstanding performance record of the Westinghouse A-C Generator. It's built there. That's why operating efficiency is so high—maintenance costs so low.

If you want your A-C generator to deliver maximum long-life performance—specify Westinghouse.

Write for booklet B-3028 describing this generator in detail. Address Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

J-10223



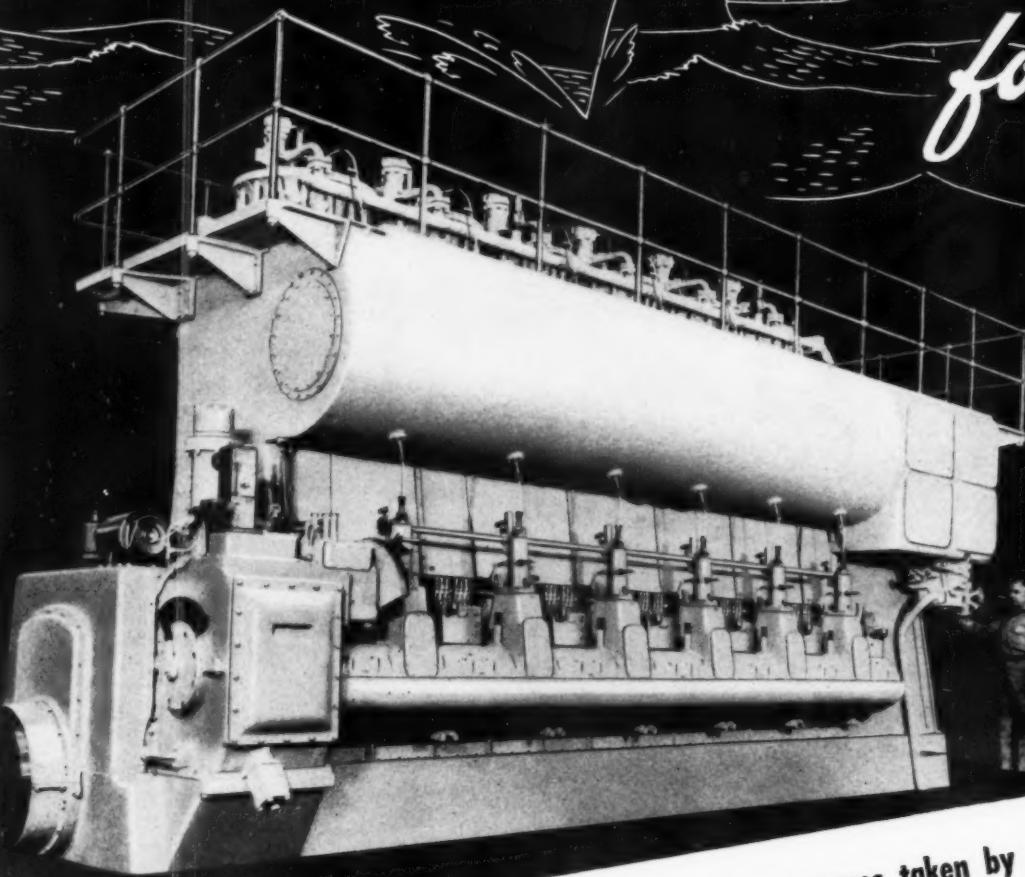
FOR DIESEL ENGINE DRIVES

Westinghouse

A-C GENERATORS

DEPENDABLE POWER

for MARINE SERVICE



DEPENDABLE
PERFORMANCE

EASE OF
MANEUVERING

SIMPLE
DESIGN

ECONOMICAL
OPERATION

GEARED OR
DIRECT DRIVE

proven on some of the longest voyages taken by American vessels.

attracting world-wide attention because of exacting central control.

appeals to engine room staff because of reliability and ease of handling.

on low grade inexpensive fuels makes greater operating profits possible.

available depending on the service of the ship and preference of purchaser.

NORDBERG MFG. CO.
MILWAUKEE



NORDBERG
DIESEL ENGINES

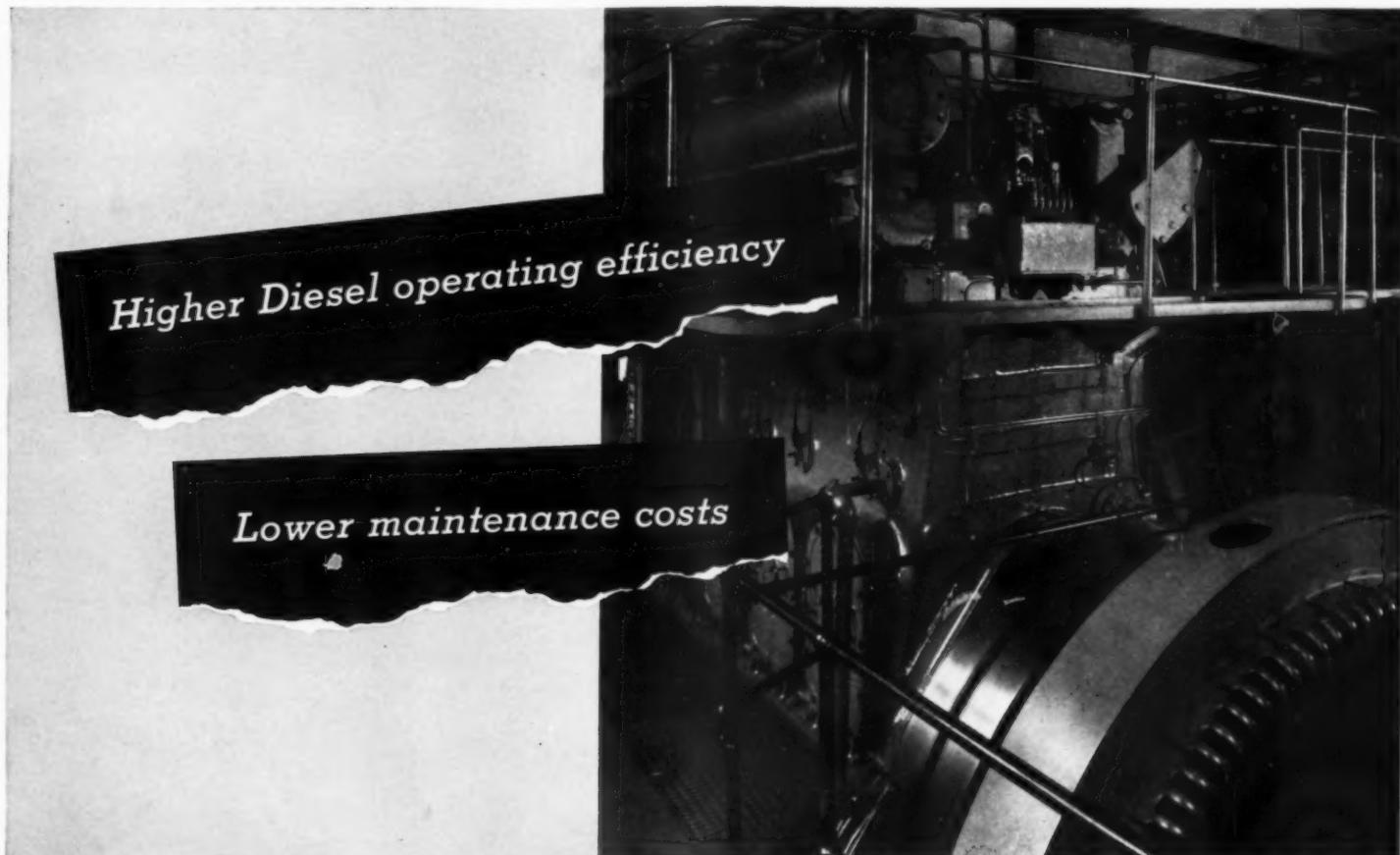


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Improved Lubrication with Gulf Parvis Oils pays dividends:



Gulf Parvis Oils are writing a list of definite benefits in the operating records of hundreds of Diesel engines. The list includes greater efficiency, lower maintenance costs, fewer shutdowns for repairs, and longer service life.

Here's the important reason for the outstanding performance of Gulf Parvis Oils: Built into these quality oils through constant research is *superior lubricating value*, insuring better protection to moving

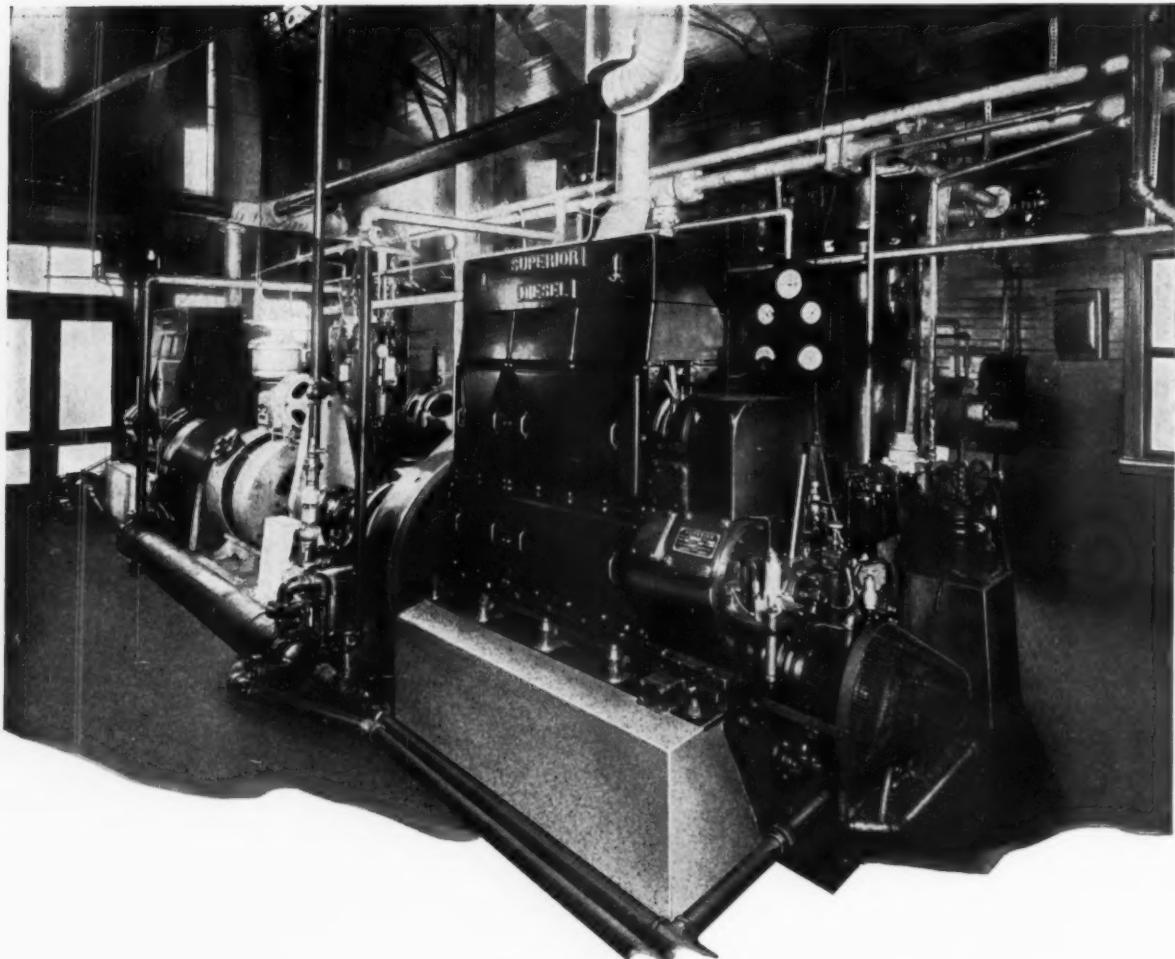
parts under today's peak load and overload operating conditions.

For effective help in improving the lubrication of your Diesels, call in a Gulf Lubrication Service Engineer and ask him to recommend the proper grade of Gulf Parvis Oil to fit your particular requirements. He has had broad practical experience with all types of Diesel engines. Write, wire, or phone your nearest Gulf office today.

Gulf Oil Corporation · Gulf Refining Company
Gulf Building, Pittsburgh, Pa.



It will pay you to investigate—call in a Gulf Lubrication Service Engineer



Ice Production Cost Reduced 64% with *Superior Diesel*

THE two 3-cylinder Superior Diesels shown above were installed in the plant of a well-known ice company in West Virginia.

Carefully kept records have shown that this installation has reduced the cost of producing ice from \$1.08 per ton to 37c per ton — a very real tribute to the practical economy of Superior Diesel Engines.

SUPERIOR ENGINES

Division of The National Supply Co.

Executive Offices: Pittsburgh, Pa.

Sales Offices: Springfield, Ohio; Boston, Mass.; New York, N.Y.; Philadelphia, Pa.; Jacksonville, Fla.; Houston, Texas; Fort Worth, Texas; Tulsa, Oklahoma; Los Angeles, Calif.; Chicago, Ill. Factory: Springfield, Ohio.





Mountain movers



Something special in metal has a place in these bulldozers

ArmaSteel*

Not long ago a war correspondent in North Africa referred to the combat in a certain area as a "bulldozer's war." It was the efficiency of American earth-moving equipment that set the pace of the attack.

Knowing that "ArmaSteel was there" in the Diesel engines that power many bulldozers is a real source of satisfaction to Saginaw Malleable. It represents another important application of this versatile metal which is serving in tanks, trucks, armored cars, amphibious trucks, small arms, machine guns, aircraft cannon, landing boats, sub chasers and other war equipment.

Wherever ArmaSteel is used, it is saving machining time and tool wear . . . replacing critical steels and alloys . . . contributing to dependable performance through accurately-controlled properties of hardness, fatigue life and strength. Make use of ArmaSteel castings in your production.

**Let's Have A Home-Front Offensive
BOOST BOND SALES**

**SAGINAW MALLEABLE IRON
DIVISION OF GENERAL MOTORS
Saginaw, Michigan**

*Reg. U. S. Pat. Off.

CAST FOR A LEADING ROLE IN INDUSTRY

CLEARING THE DOCKS



ENTERPRISE AUXILIARY ENGINES

Convoys sail on time. Ammunition, food, tanks, oil, all supplies of modern battle are cleared off docks and stowed in waiting ship holds rapidly. Enterprise Diesel Engines are performing this vital war task with outstanding speed and safety records in all ports. Lives are saved, battles won, because Enterprise Engines do meet the driving pace of wartime cargo handling.

Low port costs...the desire of operators. This objective is achieved with Enterprise DSG Engines by combining simplicity of design with compact ruggedness, burning heavy fuel oils with unusual economy. Cargo winches, pumps, and other equipment, are powered with time-saving efficiency regardless of whether the load is intermittent or continuous.

ENTERPRISE ENGINE & FOUNDRY CO.

SAN FRANCISCO
SEATTLE



WASHINGTON, D.C.
NEW YORK







FIT THE VALVE TO THE SERVICE

KEEP SHIPSHAPE

with

...WALSEAL
valves, fittings and
flanges



...WALWORTH'S
COMPLETE LINE OF
valves, fittings, pipe
and pipe wrenches

Where brass or copper pipe or tube is used in power plants, afloat or ashore, Silbraz joints made with Walseal valves, fittings, or flanges, should be installed. Silbraz joints have proven their ability to withstand bomb shock and vibration, resist corrosion, and remain tight and leakproof. The joints cannot creep or pull apart under any temperature to which the tube or pipe can be safely subjected. Silbraz joints are easy to install, even in difficult locations, and they keep piping systems shipshape. Write for detailed information.

To help you "fit the valve to the service" you will find pertinent information on Walworth's complete line in Catalog 42. Included are 78 pages of practical engineering data that simplify valve selection and make piping layouts easier. Write on your business stationery, for your free copy. Address: Walworth Company, 60 East 42nd Street, New York 17, N. Y., Department D14.



BOSTON WORKS
KEWAENE WORKS

WALWORTH
valves and fittings

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD





OFFICIAL U. S. NAVY PHOTOGRAPHS



Seeing Pictures Like These

Makes the Headaches Worthwhile

As with most other plants, Busch-Sulzer found it no easy matter to throw its peacetime procedure by the board overnight and get into a full stride of war production. The Navy wanted ammunition hoists above all and quickly. Men, machines and tools had to start from scratch. New men had to be trained. Obstacle after obstacle had to be overcome.

Sooner than we hoped for, the ammunition hoists began leaving our plant. The Navy wanted Diesels and got them, too. The Department awarded Busch-Sulzer its E—and then a star, a second star and now a third.

Now, these official U. S. Navy photographs show

what the headaches have helped to accomplish. The 'flat top' is the U. S. S. Long Island, an auxiliary aircraft escort vessel of the type that has been much in the news lately. It is powered by Busch-Sulzer Diesels. The other picture shows the 5"/38s of a battleship being fired. These dual-purpose guns are served by ammunition hoists of the type made by Busch-Sulzer. The hoists are made with watch-like precision. Just what they do for the gun is one of those stories that will astonish you after the war.

Right now it's good to know that skilled American workmen have done and are doing their share to hasten the hour of victory.



BUSCH-SULZER BROS. DIESEL ENGINE COMPANY
SAINT LOUIS



AMERICA'S OLDEST BUILDER OF DIESEL ENGINES





SHAFTING

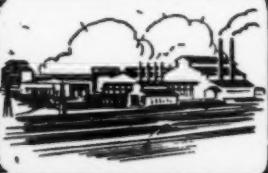
by
ERIE



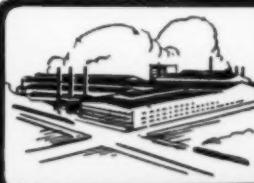
SHIPS FOR
VICTORY

Forgings . . .

- By the Erie Forge Company, finished for Diesel Crankshafts, Line Shafts and other forged parts, are driving the Nation's Ships for Victory . . . Forgings and Steel Castings are produced at Erie Forge Company under One Responsibility and with One Control . . . You can depend upon the Quality and Service which this complete control, from raw material to finished product, accords your requirements when you place them with us.



ERIE FORGE COMPANY, ERIE, PA.





Washington's Crossing...1943 Style



Far cry from a rowboat on the Delaware are today's water-borne armies of invasion, requiring the utmost precision—the greatest coordinated armadas of naval ships, transports, supply ships, landing craft, etc., ever assembled.

And even before the Marines and Doughboys have landed, Sylphon Control Instruments "have the situation well in hand" as far as maintaining efficient, safe engine temperatures is concerned, on board many internal combustion engine and diesel-powered craft—are standing by, ready to do the same for the aircraft, tanks, tank destroyers, combat cars, and trucks that will flow ashore in endless streams when the beachhead has been reached.

These Sylphon Bellows-powered devices—similar to the Sylphon Temperature Controls so widely used in electric refrigerators, automobile engines, stationary

diesels, industrial processes, heating and air conditioning systems and countless other products—are attracting greater and greater engineering attention to the possibilities of designing superior products around the Sylphon Bellows.



Sylphon Products include: *Aircraft Controls*—Liquid Cooled Engine Thermostats, Oil Cooler Thermostats, Oil Cooler Surge Protection Valves, Damper Controls for Cabin and Wing Heating, Fuel Pressure Regulating Valves; Parts for Super-Charger Controls, Carburetor Controls, Fuel Injector Controls; *Marine Controls*—for the Regulation of Fresh Water Heaters, Fuel Oil Heaters, Lubricating Oil Temperatures, Diesel Engines, Desuperheaters, Steam Jet Ejector Condensers; *Automotive Controls*—Engine Temperature Controls for Tanks and Other Military Vehicles, Trucks and Passenger Cars; *Refrigeration Controls*—Thermostat Mechanisms for Domestic and Commercial Refrigerators; *Industrial Controls*—Temperature, Pressure and Vacuum Controls for Industrial Processes; *Air Conditioning Controls*—for Buildings, Ships, Railroad Trains, Aircraft.



THE FULTON
KNOXVILLE

SYLPHON CO.
TENNESSEE

Temperature Controls...Bellows...Bellows Assemblies







Photograph taken at Sperry Gyro-Compass School

The United Nations go to school

THE OWNERS of those hats are learning about the Sperry Gyro-Compass the practical way. These representatives of the United Nations are seeing it in action in the Sperry Gyro-Compass School.

Many of the men who own those hats will be on convoy duty soon. They already know the risks of submarine warfare and surface contact. They know that lighthouses are dark these perilous nights, that radio beacons are silent, lightships are gone, weather reports no longer available, and even the use of radio communications rigidly limited.

And they know they may sail in prefabricated hulls built under conditions involving immense variation in residual magnetism. Their cargoes may be highly magnetic and their ships almost certain to be equipped with degaussing

apparatus to render ineffective the sensitive magnetic mines that lurk in their path.

These factors spell the need of attaining absolute precision in navigation and call for navigation equipment that is impervious to profound and diverse magnetic influences.

That is why these sea-going men are learning about the Sperry Gyro-Compass and why it is more essential than ever in war time. In the course of their study, they learn too that the substitution of electronic circuits* for roller contacts in the follow-up system of the new compass assures even greater reliability with less care and maintenance than before.

When these men pick up their hats for the last time in the Sperry Gyro-Compass School and board their ships,

it will be with full knowledge of and confidence in the Sperry Gyro-Compass.

* The Sperry electronic Gyro-Compass is sometimes called the Sperry Gyrotronic (registered trade-mark) Compass.

SPERRY
GYROSCOPE COMPANY, INC.

Brooklyn, New York
Division of the Sperry Corporation



Who can apply PORUS★KROME^{*}?



Diesel cylinders in the electroplating bath, one of the operations in the process of applying PORUS-KROME.

Applying PORUS-KROME calls for more than an electroplating tank and a knowledge of electrochemistry. It is a precise engineering process.

PORUS-KROME...with all its improvement in engine performance and with all the benefits of Van der Horst's long experience and expert engineering...is available to you in two ways. Both are under the Van der Horst patents that fully cover the process of application.

First, you can apply PORUS-KROME your-

self under a Van der Horst patent license, as a number of manufacturers are now doing. Van der Horst will help you lay out your plant and guide you in its operation.

The other way is to have PORUS-KROME applied to your cylinders or other engine parts by one of the Van der Horst plants.

So the answer to the question "Who can apply PORUS-KROME?" is "You can" or "Van der Horst can". We will be glad to help you determine which is best for you.

*PORUS-KROME is hard chromium having controlled porosity and smoothness. It is applied with precision to internal combustion engine cylinder bores and other bearing surfaces to reduce wear, corrosion and scuffing and to lengthen engine life.



PORUS★KROME

Multiples Engine Life

VAN DER HORST CORPORATION OF AMERICA

CLEVELAND, O.
OLEAN, N. Y.





**DESIGNED FOR THE Rigors
OF WARTIME SERVICE...**

"DL"

Contact Makers are made in both temperature and pressure operated types, and when used with a suitable alarm system, provide reliable protection against high cooling water and bearing temperatures, or low lube-oil pressure, on all types of Diesel, gasoline and gas engines.

Designed to meet the requirements of the U. S. Navy and Maritime Commission, these contact makers are rugged and dependable. They will continue to operate even when completely submerged in water or when subjected to stunning blows or severe vibration. "DL" Contact Makers can "take it".

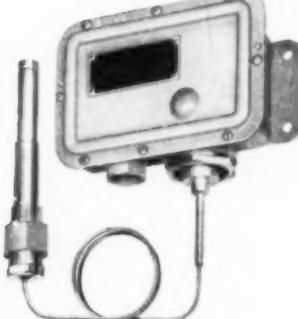
The same reliable protection afforded the engines of our fighting ships can also protect your engine from costly damage.

Let us send you more information.

No. 220-16
Model NB-1
Pressure Operated
Contact Maker



No. 220-16
Model NL
Temperature Operated
Contact Maker



DETROIT LUBRICATOR COMPANY

General Offices: DETROIT 8, MICHIGAN

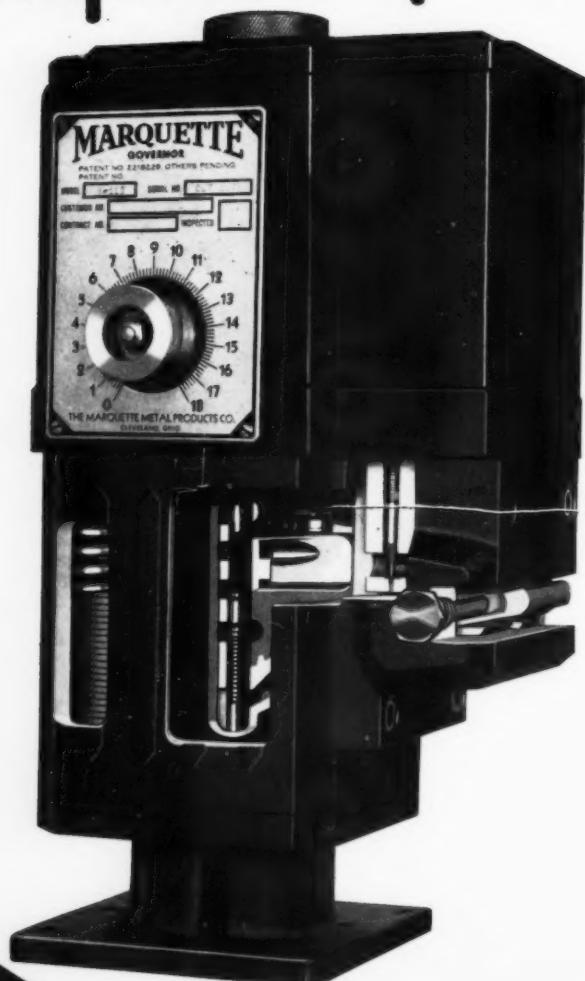
Division of AMERICAN Radiator and "Standard" Sanitary Corporation

Canadian Representatives—RAILWAY AND ENGINEERING SPECIALTIES LIMITED, MONTREAL, TORONTO, WINNIPEG



"DL" Heating and Refrigeration Controls • Engine Safety Controls • Safety Float Valves and Oil Burner Accessories • Radiator Valves and Balancing Fittings • Arco-Detroit Air and Vent Valves • "Detroit" Expansion Valves and Refrigeration Accessories • Air Filters • Stationary and Locomotive Lubricators

Simplicity of Design



HYDRAULIC GOVERNORS
AND OVER-SPEED TRIPS

The Marquette METAL PRODUCTS CO.
CLEVELAND, OHIO



RS
PS





SUN LUBRICANTS

Reduce Diesel Shutdowns 75% In Cold Storage Plant

In the face of the critical shortage of foods, unfailing cold storage is vital. Every step should be taken to avoid downtime in refrigeration . . . and putting the right petroleum product in the right place is one of the most important steps.

A large cold storage plant proved this when they switched to SOLNUS OILS. Previously their diesels had to be shut down for inspection and cleaning at frequent intervals due to excessive carbon formations. Oil filters were so clogged with carbon and sludge that they had to be replaced.

After the switch to SOLNUS, shutdowns for inspections

were reduced 75%. Hard carbon troubles vanished. SOLNUS OILS keep the plant running day and night without breakdowns due to faulty lubrication. These wholly distilled, durable lubricants are low in carbon content—neutral in acidity.

What have you done to put your plant on a more efficient war-time operating basis? Talk it over with a SUN "Doctor of Industry" and let him prove to you the value of applying the right petroleum product at the right place. Write

SUN OIL COMPANY, Philadelphia

Sun Oil Company, Limited . . . Toronto, Canada

SUN PETROLEUM PRODUCTS



HELPING INDUSTRY HELP AMERICA



Official U. S. Army Signal Corps Photograph

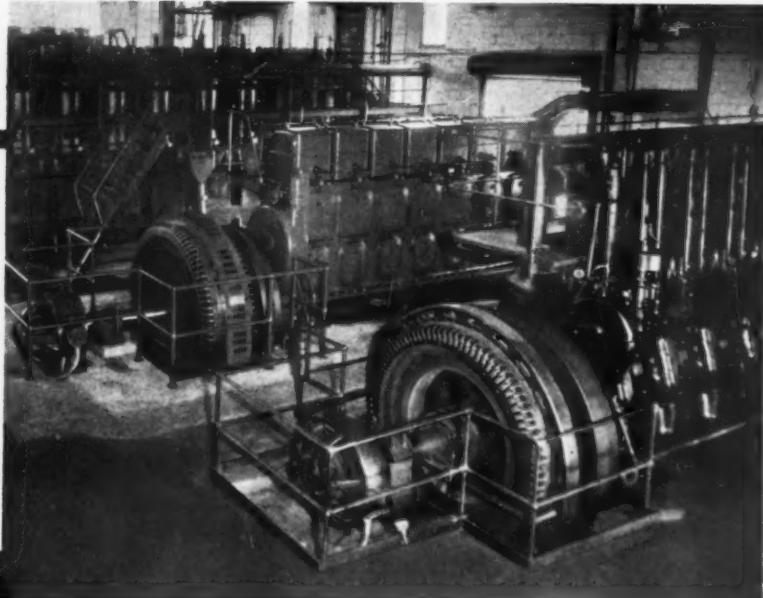
POWER TO ATTACK

relies on power production.
For stepped-up output from
DIESEL engines use . . .

**....SINCLAIR
RUBILENE OILS.**

Rubilenes promote clean operation under continuous heavy loads . . . longer service periods between overhaul lay-offs . . . low oil consumption and reduced maintenance cost.

(Write for "The Service Factor"—published periodically and devoted to the solution of lubricating problems.)



SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY (INC.), 630 FIFTH AVENUE, NEW YORK 20, N. Y.



M

PR



"We make Parts

for the Big Boys, too!"

McQUAY-NORRIS ALTINIZED PISTON RINGS

For several years, McQuay-Norris parts have been contributing their precision and stamina to Diesel engine performance. And because McQuay-Norris always keeps pace with Diesel developments, our work in this field is constantly expanding. More and more, Diesel manufacturers are avail-

ing themselves of our clinical research, our engineering and technical experience. McQuay-Norris products are backed by thirty-three years' experience in making precision parts for the transportation field — cars, trucks, tractors, airplanes and ships. Send us your blueprints.

McQUAY-NORRIS MFG. CO.

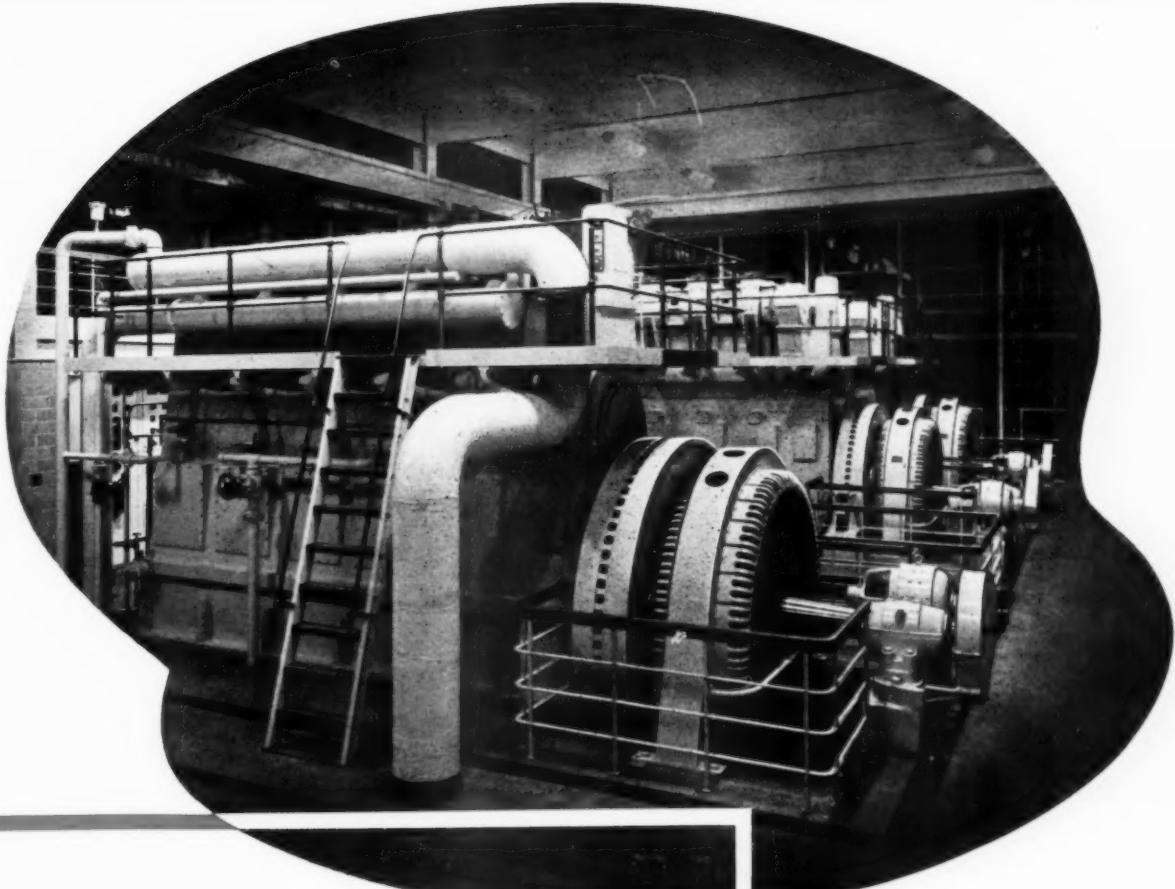
ST. LOUIS, MO.

PRECISION WORKERS IN IRON, STEEL, ALUMINUM, BRONZE, MAGNESIUM



Inside
Os a
Plane
alter
exit
to F
engi

Inside the handsome new Osage, Iowa, Municipal Plant. Three Elliott 500-kw. alternators with chain-driven exciters are direct-connected to Fulton 257-r.p.m. Diesel engines.



Fine generators make fine plants

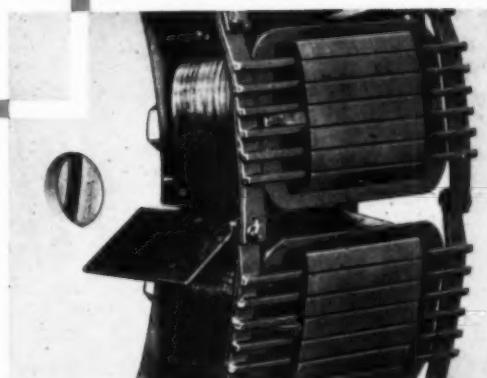
Good-looking municipal plants are an expression of civic pride as well as of thrift and care in the expenditure of municipal funds. For these plants invariably have equipment in keeping with their good looks — equipment with low operating costs and fine performance.

Like the plant at Osage, Iowa, triumph of architectural beauty and also of engineering excellence, with its three fine Diesels driving three equally fine Elliott generators. Surprisingly often in plants like this, the Elliott monogram marks the business end of the generating units.

ELLIOTT COMPANY
Electric Power Department, RIDGWAY, PA.
DISTRICT OFFICES IN PRINCIPAL CITIES



A star has been added to the Army-Navy "E" flags flown by both the Jeannette and the Ridgway plants of Elliott Company.



DETAILS TELL THE STORY

note the strap wound field coils, permanently wedged in place. The damper winding in the pole faces is of heavy construction. The short circuiting rings have bolted joints, giving continuous ring advantages while permitting easy removal of a single pole. Skewing the pole slightly on the spider effectively minimizes noise. Fans attached to the rotor rim provide adequate ventilation. Holes in the spider allow easy handling.

Details like this put quality
into Elliott generators.

Elliott makes fine generators



C One Hundred and Ten Years Young! D

As Cooper-Bessemer passes this important milestone in its second hundred years, our energies are focussed on two all-important objectives:

1. Now we are concentrating 100% on war production—building diesel and gas engines, compressors, and foundry products, to help win the war as soon as possible.
2. We are preparing, after Victory, to manufacture improved power equipment of several types—

to meet a peacetime demand for efficient, low-cost horsepower which promises to be the biggest we have seen in our 110-year history.

This is the fifth American war in which Cooper-Bessemer has had a share in the winning. For the fifth time, also, an all-out war experience has made us young. It will assist us to serve America all the better, for post-war reconstruction and peacetime prosperity.

THE **Cooper-Bessemer**

CORPORATION

Mt. Vernon, Ohio • Grove City, Pa.

BUILDERS OF DEPENDABLE ENGINES FOR 110 YEARS

